EDITORIAL

DURING the past month two men learned the hard way that regulations governing the use of radio transmitters are there to be observed.

● In Western Australia a man was prosecuted for originating false messages purporting to come from a yacht in distress. The search, which was instituted as a result of the messages, involved considerable expense and risk to the participants.

● In Victoria, another man set up a transmitter on the 19-metre band, broadcasting music and advertisements, allegedly "for the benefit of the Greek community." He pleaded that the transmissions were completely innocuous.

But whether mischievous or innocuous is not the point. Only by framing—and observing—suitable regulations is it possible to maintain order in the use of the ether, which is surely the most public of all domains.

All unauthorised transmissions jeopardise this order, whether they are originated in ignorance, or as a practical joke, or by a misguided technician or yet by some rugged individualist who regards all regulations as an invasion of personal liberty.

For those who are really keen to operate their own radio station, proper provision is made in the "amateur" bands. It is not even necessary to pass the Morse test, which once deterred so many. Nowadays, with a little extra study, any reasonably informed enthusiast can pass an examination entitling them to operate in the VHF sector.

To be sure "Radio, Television and Hobbies" has more than once criticised details of the regulations governing amateur radio but we will not budge an inch from observing them while they are in force. For this reason we never publish elementary transmitter circuits which readers might be tempted to put together "for the fun of it."

At the same time we believe that the newly formed committee to investigate frequency allocation should examine carefully the proposition of a VHF "Citizen Band." By allowing anyone to use, on a specific frequency, equipment conforming to rigid standards, the authorities would meet the need, expressed by so many, for occasional short-distance radio communication.

Objections that a citizen band would rapidly become useless by reason of interference is hardly valid. In fact, the ambient interference level could provide an automatic deterrent to "DX rag-chewing." It would be no hazard at all to farmers, sportsmen, surveyors and anyone else in need of short-distance mobile communication.

W. N. Williams

INDEX

	Page
Luxury Liner Shows Her Paces	3
Motor Transport of the Future	4
New BBC Television Centre	9
Isotopes Solve Many Problems	13
Space Journeys—Fact or Fiction?	16
Review—Optical Polishing and Mating Seals Valves	21
Review—Man Run Radar Watch	23
Review—Europe to Integrate Air Control	25
Science and Industrial News	29
Compact 6 Band Oscillator	32
The Serviceman Who Tells	45
Four-element Two Metre Beam	52
Here's Your Answer Tom	60
Three Inch CRO Part 2	64
Sound For 8mm Amateur Films	75
A Reader Built It	81
Transistorised Wavemeter	84
Let's Buy An Argument	92
Off The Record—News and Reviews	96
In Review—by Julian Russell	101
Trade Reviews	106
Book Reviews and Comments	109
Amateur Bands	112
On Shortwave	117
Answers To Correspondents	120
"R., TV and H." Crossword	127

RADIO TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION HOBBIES AND POPULAR SCIENCE

EDITOR
NEVILLE WILLIAMS
M.I.R.E. (Aust.) (VK2XV)

TECHNICAL EDITOR
PHILIP WATSON
A.M.I.R.E. (Aust.)

TECHNICAL STAFF
JOHN BARKER
BRIAN CLEAVES
JAMIESON ROWE
MERVYN HUDDLESTON

Vol. 22 No. 6

SUBSCRIPTION RATES

C'wealth, Fiji, N. Guinea, £1/15/- p.a.
United Kingdom and N.Z., £A2 p.a.
British Dominions £A2 p.a.
Foreign £A2/10/- p.a.

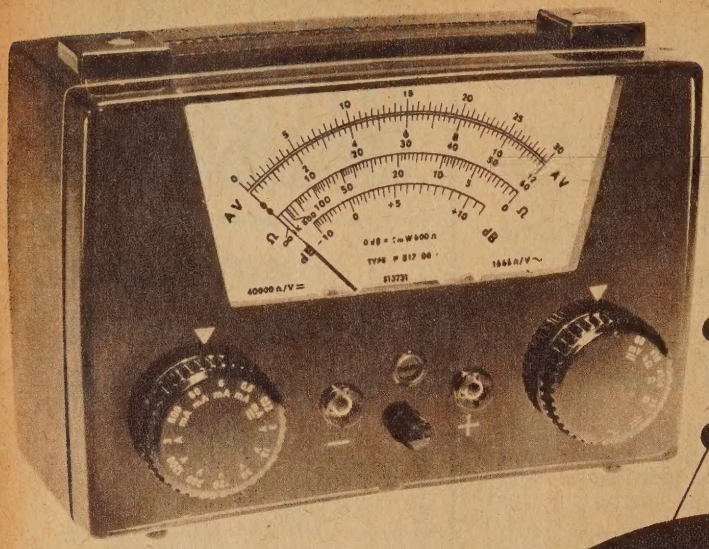
Editorial Offices . . . Jones St., Broadway, Sydney.

Postal Address . . . Box 2728 G.P.O., Sydney.

Phone B0944

OUR COVER PICTURE

With the rapid advance of jet airliners we are apt to forget that the ocean liner still plays a vital role in world communications. The latest product of British shipyards is the £10m, 38,000 ton Windsor Castle, seen here undergoing her speed trials in the Clyde.



PHILIPS

40,000 Ohms per Volt

Multimeter

40,000 Ohms per Volt DC sensitivity has been made possible by a new method of meter movement supension enabling sturdy construction of the 25μA meter.

The instrument features:—

1. **40,000 Ω/V DC voltage sensitivity**
2. **Large, easy-to-read meter**
3. **Protection against overload**
4. **Current transformer for AC measurements**
5. **Low to high ohms ranges**
6. **Light construction for portability**

28 Ranges

DC

Volts 0-60 mV to 0-1200V (with EHT Probe 0-30 KV) Current 0-30μA to 0-3A.

AC

Volts 0-3V to 0-1200 } 30 c/s -
Current 0-600μA to 0-3A } 10kC/s

OHMS

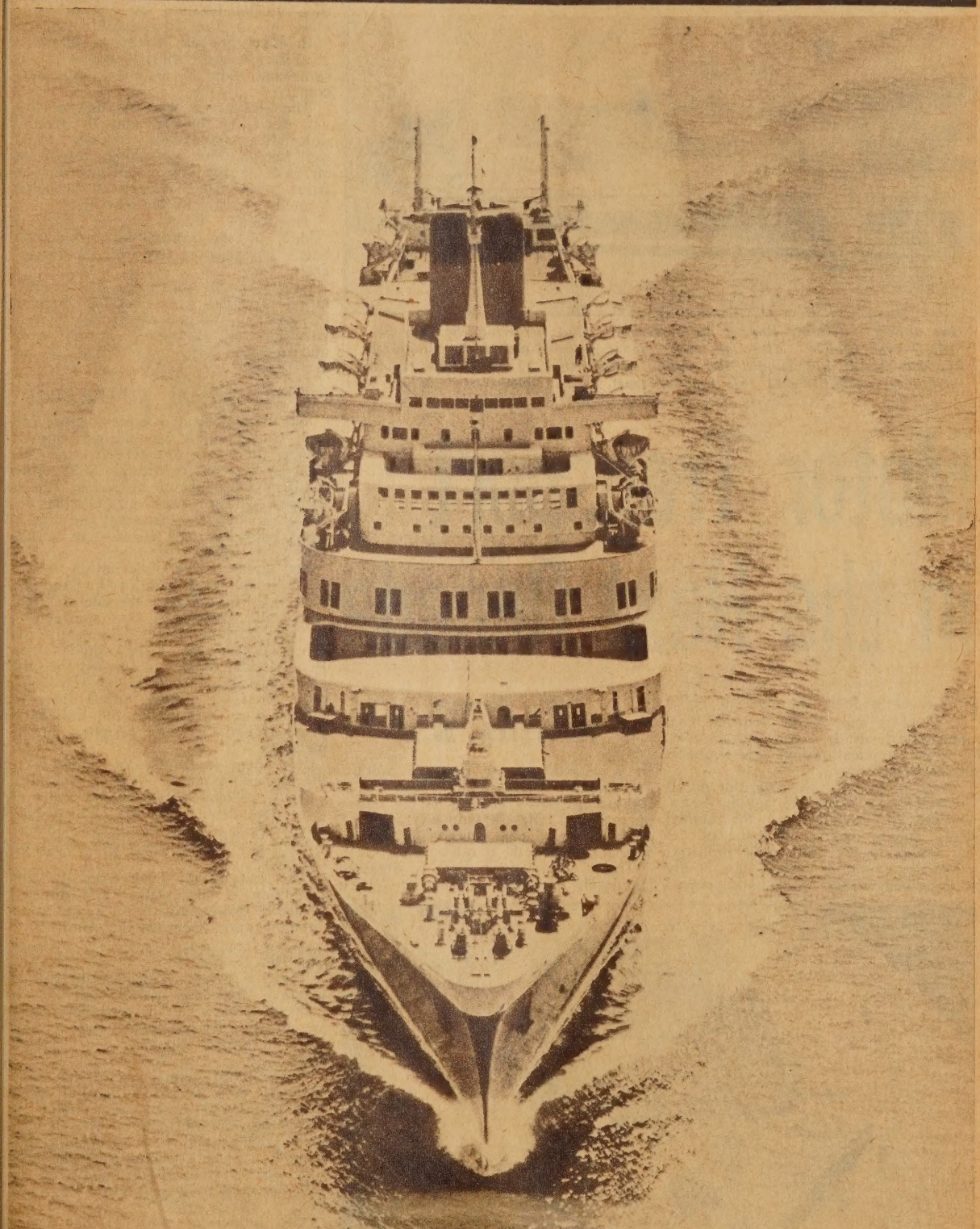
0-1000Ω 0-100 KΩ 0-10 MΩ

Carrying case with shoulder strap is available

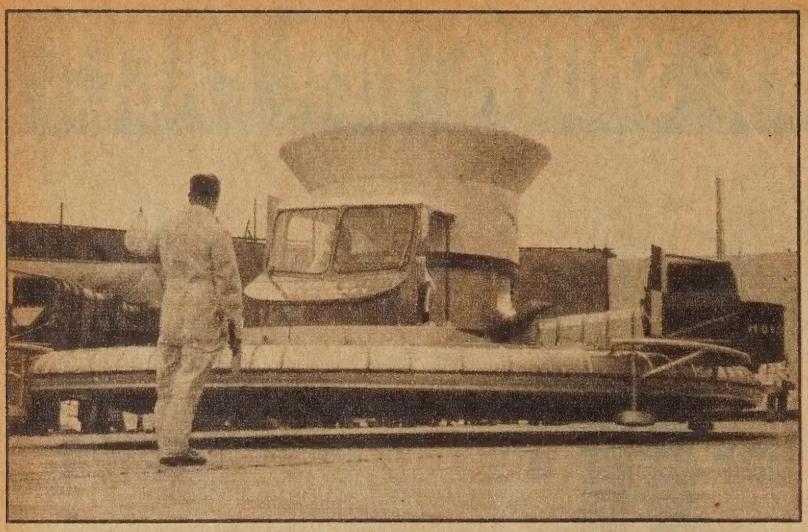
PHILIPS ELECTRICAL INDUSTRIES PTY. LIMITED

SYDNEY • MELBOURNE • BRISBANE • ADELAIDE • PERTH • HOBART

LUXURY LINER SHOWS HER PACES



Another spectacular aerial shot of the Windsor Castle "turning it on" during her speed trials. Designed to cruise at over 20 knots, she would be capable of speeds in excess of 25 knots during her trials. The largest British ship since the Queen Elizabeth, the Windsor Castle was built by Cammell Laird's shipyards for the Union Castle Line. Designed to carry 250 1st class passengers and 600 2nd class, the new luxury liner has air conditioning in every cabin, two swimming pools, and all the amenities for a luxury cruise. Not as fast as a jet perhaps, but a good deal more relaxing.



One almost inevitable line of development is that involving the "air levitation" type vehicle. Although only a developmental model, the Saunders-Roe Hovercraft has caught the public imagination by demonstrating the intriguing possibilities of this type of craft. It is shown here during an early demonstration "flight."

Motor Transport in the Next Decade

by Sturt Griffith, B.E.

EVER since their introduction about 70 years ago, motor vehicles have rolled on wheels. It is now certain that, for some applications at least, wheels will be eliminated.

A new type of vehicle, operating on an "air-levitation" system, is making its appearance in England and the United States, and is backed by some of the best brains in the automobile industry.

An air levitation vehicle can briefly be described as one which is supported on a cushion of air when in motion. The English Hovercraft was the first of this strange new type, and having ridden on a Hovercraft, in company with 12 other people, I can vouch that it gives a perfectly smooth, if rather noisy, ride.

The air levitation effect is obtained by simply directing an enormous blast of air downwards from the vehicle. The reaction lifts the vehicle a foot or 18 inches above the surface, be it land or water.

This is merely the means of suspending the vehicle, ready to progress. It is then moved forward by one or more blasts of air directed horizontally.

In effect, the air levitation vehicle is an aircraft, but without wings. It is somewhat akin to a low-altitude helicopter.

The Hovercraft was the first of this new form of vehicle, and its general saucer-like appearance is now fairly well known. The supporting cushion of air is established by a downward blast from a jet engine or aircraft propeller located centrally in the vehicle.

Horizontal ducts along opposite "sides" of the saucer deliver the air blasts that progress and steer the Hovercraft.

Several motor cars using the air levitation principles are under development in America. The one which most closely resembles an automobile is that built and operated by Curtiss-Wright, of aircraft fame.

CONVENTIONAL APPEARANCE

The body shell and superstructure follow conventional car design; but of course there are no wheels, and the sides of the car are brought right down to form a level skirt. Instead of wheels the powerful downward air-blast lifts the car a foot above the ground, and a rearward blast drives it forward at speeds up to 60 m.p.h.

Yet another type of levitation vehicle is under development in England by Britten-Norman Ltd. of the Isle of Wight where the Hovercraft was spawned.

This machine carries the aptly descriptive name of "Cushioncraft," and is of circular shape. In this instance the downward blast to lift the vehicle is engendered by a huge vaned rotor or turbine ring, rotating in the horizontal plane around the outer periphery of the machine.

For sheer ingenuity, this craft takes the bun. The power plant is a 2 litre Coventry Climax engine in the centre of the saucer, driving the peripheral turbine ring through a single car wheel and tyre pressed heavily on to a driving track on the ring.

The annular air blast from the turbine ring is straightened and directed vertically downwards by a plurality of directing vanes beneath the rotor.

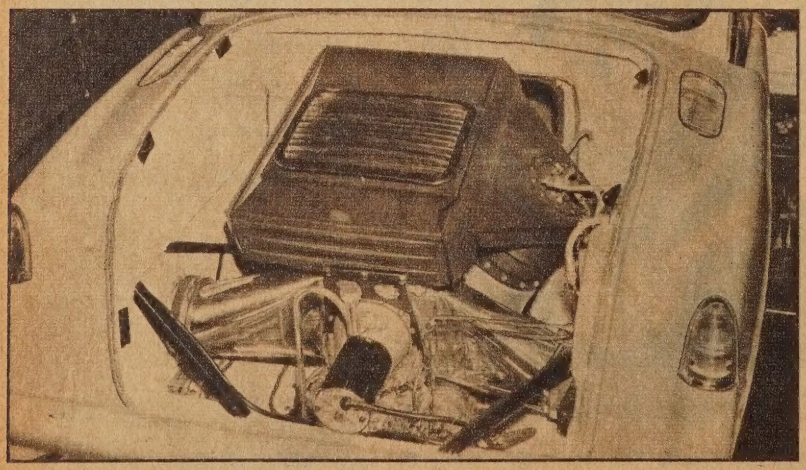
LITTLE TORQUE

There is not a great deal of torque reaction from this set-up, and this is neutralised by a pair of propellers rotating in the vertical plane, which also serve to propel and steer the Cushioncraft.

The Climax engine is of the high efficiency twin overhead camshaft type, developing 170 brake horsepower. It drives the wheel through an MG change-speed gearbox, and the propellers through a bevel box. A Michelin X (steel cord) tyre, operating at speeds equivalent to 150 m.p.h., is used to transmit the drive to the turbine ring.

The moderate size of the power plant, which is no larger than used in a medium-sized car, is an important feature in bringing this air levitation vehicle into the realm of practical use.

The Cushioncraft will, on this limited power, lift and transport three or four passengers. The machine boasts a comfortable cabin for its passengers, and it



Another obvious line of research is the development of alternative type engines. In some applications at least the gas turbine is destined to replace the piston engine, and the one depicted here is a developmental model produced by the Rover company and fitted to the rear compartment of a regular sports car body.

carries 60 gallons of petrol, which give it an endurance of six hours travelling, at 5 gallons per hour normal consumption.

It has a maximum diameter of 18½ft so while it is wider than any conventional motor vehicle, it is no longer than a large limousine, and it could be operated on a one-way road.

Let us beware of regarding the air levitation vehicle as the amusing brainstorm of a slightly crazed aircraft designer. It will have its very practical applications, and indeed may revolutionise public transport as the first step.

There seems to me to be no insuperable difficulty in constructing an air levitation vehicle which will carry a number of people over a prepared road or track at very high speeds.

ON LAND AND SEA

From the practical operation of the Hovercraft in England and across the Channel, it is clear that in essence this type of vehicle only needs a reasonably even track to follow on land, and moderately smooth water to operate at sea.

This goes for the vehicle in its present elementary stage, which could be likened to the aeroplane in the Wright Brothers stage of its life. With development will surely come versality, less power or more speed, and endless refinements.

It is not, I believe, over optimistic to envisage special tracks, for instance existing railway tracks, over which public levitation vehicles would ply from city to city, or from suburb to suburb.

These tracks need be quite simple, and preferably would have guide rails engaged by the vehicle for steering purposes only. The suspension system would be that silent and smooth cushion of air which offers no friction or impedance to rapid progress.

Within the realms of present possibility is a vehicle of normal elongated shape to carry 50 people, and operating at speeds of several hundred miles per hour.

Another virtue of the levitation car is its ability to cross water as readily as land. For instance, one could drive on a simple track or road which led into the harbour, and cross the water without even parking.

Bridges for levitation vehicles across permanent rivers or other stretches of water would be unnecessary—merely gently inclined ramps on either side.

Here we have a discovery in the surface-transport field which could be as important as was the invention of the aeroplane for use above the earth's surface.

In the realm of car engines also there have been notable advances. The present piston engine is an excellent and reliable prime mover for motor vehicles, especially cars, but three entirely new types of engine are currently under intensive development abroad.

The most likely to first find a place in mass production cars is the rotary piston engine invented by Wankel, which has proven itself as a very practical power unit for small cars.

The principal virtue of this new type of engine is simplicity, for it has only two moving parts, and eliminates all the complicated valve gear of conventional engines operating on the four-stroke cycle, which is followed in this engine.

Its simplicity spells cheapness of production, and even greater reliability in operation, particularly when worked hard or abused.

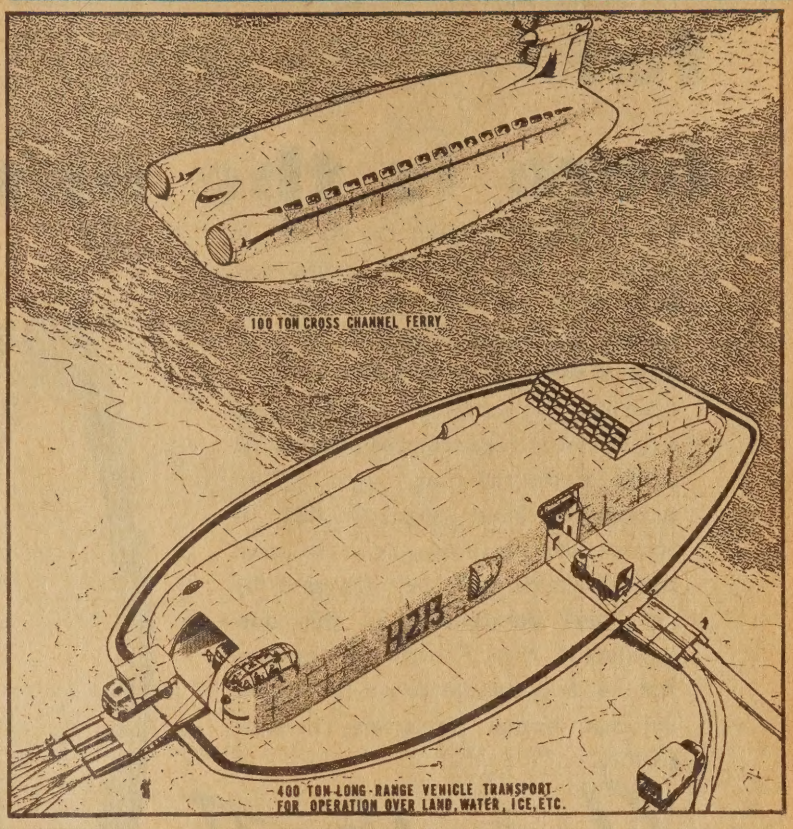
PROMISE

After a brief three years of development, the Wankel engine shows great promise, and has been used successfully in a small car. Some colleagues of mine who have driven the NSU Prinz car fitted with this engine in Europe advise me that the engine is exceptionally smooth and quite, and propels the car to 70 m.p.h., which is faster than with a conventional engine of equal size.

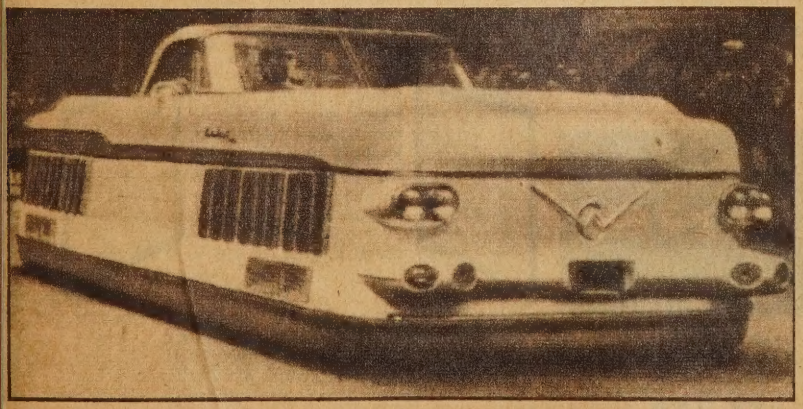
This fully rotary four-stroke engine has enormous revving potentialities, and speeds up to 9,000 r.p.m. are common. The absence of reciprocating parts, and the ease of balancing, gives smoothness at speeds quite beyond the conventional engine.

As will be seen from the diagram, the piston or rotor is of equilateral triangular shape, but with accurate sides.

HOVERCRAFT OF THE FUTURE?



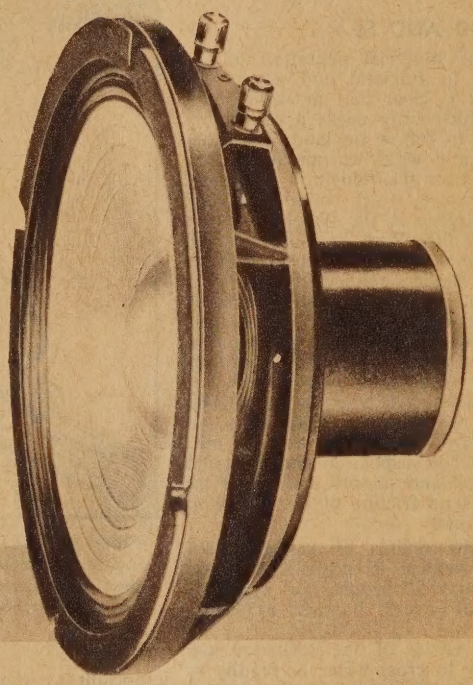
From the present experimental Hovercraft, Saunders-Roe envisage developing large passenger and freight vehicles as depicted here. They point out that efficiency rises rapidly with size, and that a 400-ton craft requires one quarter the engine power per ton of an aircraft, and can carry nearly twice the payload.



The Curtiss-Wright air levitation car has an orthodox shape but no wheels. The sides of the body are carried well down to form an even skirt, which encloses the downward air blast on which the car rides clear of the ground. Propulson is by rearwardly directed air jets, and speeds of up to 60 m.p.h. have been attained.

when space is limited for STEREO... here is the answer ...

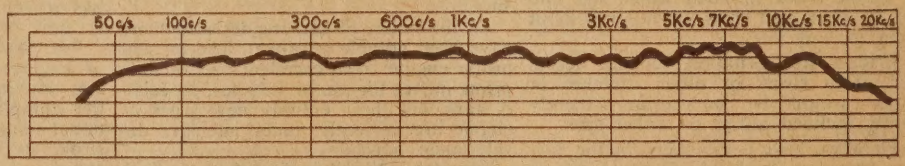
For stereophonic sound the Axiette II single-cone High Fidelity Loudspeaker offers small size (only 8⅛" diameter) without sacrifice of High Fidelity standards of sound reproduction. It provides extensive, yet extremely well-balanced frequency coverage achieved by scientific design of the radiating system. When suitably enclosed and operated at normal listening levels, even the most critical listener will be impressed by the "big" performance of this outstanding 8" High Fidelity Loudspeaker. Another important feature is the rugged, die-cast frame imparting extreme rigidity.



Axiette II

HIGH FIDELITY LOUDSPEAKERS

Typical Response Curve for Axiette II



SPECIFICATIONS:

Flux Density: 15,000 gauss. Frequency Range: 40-15,000 c/s. Fundamental Resonance: 65 c/s (nominal). Maximum Power Handling: 7½ watts (15 watts, U.S.A. rating). Impedance: 15 ohms. *PRICE: £16.*

Plans and specifications for special Reflex Enclosures for Axiette II are available from British Merchandising.

GOODMANS

AUSTRALIAN AGENT:

BRITISH MERCHANDISING PTY. LTD.

60 Clarence Street. Sydney. BX 1571

Post this coupon now for your FREE copy of the GOODMANS NEW HIGH FIDELITY LOUDSPEAKER MANUAL.

Name.....

Address.....

.....

It is eccentrically mounted in a two-node epitroichoidal casing.

The rotor, besides rotating about its own symmetrical axis, orbits about a fixed point constituting the centre of symmetry of the casing, i.e. the intersection of the long and of the short axis of the trochoid. The apices of the triangular rotor, spaced at 120deg. relative to one another, while sliding on the curved part of the trochoid, maintain a continuous contact with the latter during their orbit; crescent shaped cells or chambers of variable volume are formed between casing and rotor in which the individual stages of the four-stroke cycle takes place successively.

If the four figures of the diagram are followed around, in clockwise fashion, the operation of the Wankel engine will be clear. The rotor is moving clockwise in the casing, and the various stages of induction are indicated by numerals 1, 2, 3 and 4.

COMPRESSION STAGES

The successive compression stages are indicated by numerals 5, 6 and 7, and the charge is fired at the latter point.

The power stroke is seen at stages indicated by 8, 9 and 10, after which the exhaust port is uncovered and the charge passed out of the engine through stages indicated by numerals 11 and 12.

The rotor is internally geared to a central drive shaft which is eccentric to the rotor, as shown in the diagram. The rotor orbits around the casing at only 1/3 the shaft speed, so that the sliding speed over the casing surface is kept DOWN.

It will be seen that the Wankel engine, whilst operating on the four-stroke cycle, has ports like a two-stroke, and breathes better than a poppet valve engine.

The rotor is sealed in the casing by accurate ring segments on its side faces, and sliding vanes at the apices. This sealing was a problem which has been capably solved, without undue friction loss.

All is not plain sailing with the Wankel engine. The rotor and casing are subjected to very high thermal loading. The orbiting loads on the rotor bearings are very substantial. The cooling of the rotor, which is done by oil, is far from easy.

But these are problems which are well on the way to solution, and in a few more years of development should be problems no longer.

H.P./WEIGHT RATIO

Some interesting comparisons have been made of the new engine against the world-renowned NSU motor-cycle engine of the same capacity. Pound for pound, and bulk for bulk, the Wankel engine is far ahead of the reciprocating piston engine.

In mechanical efficiency the conventional type leads the other, but the volumetric efficiency of the Wankel is much greater, and reaches 105 per cent at speeds as high as 8,500 r.p.m.

Performance figures on the latest engine of 250 c.c. capacity show a brake mean effective pressure of 10 kg/sq. cm., and a fantastic maximum power output of 31 b.h.p., or 124 b.h.p. per litre unsupercharged. Specific fuel consumption is about 275 grammes per b.h.p.-hour.

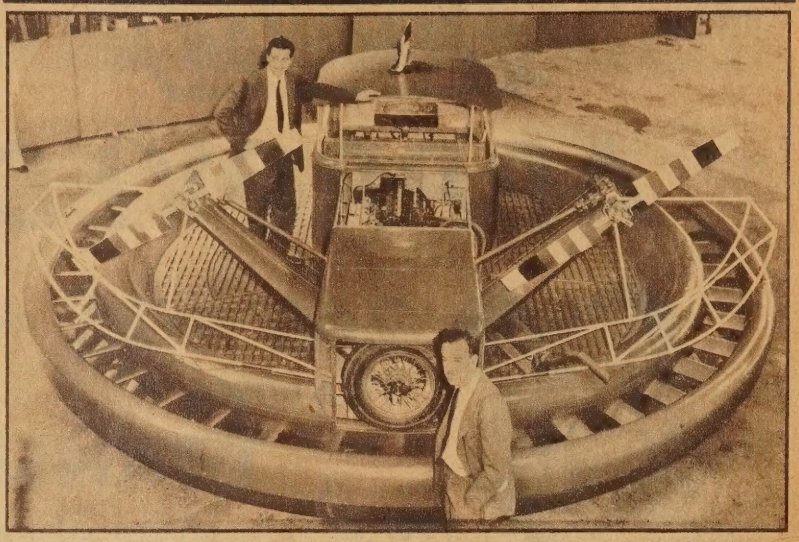
Curtiss-Wright has a franchise for the development of the Wankel engine in the United States, and it is currently working on a one litre engine. In view of the great power and torque output per unit of capacity, this is a size of engine which could amply power a large car.

This developmental engine shows no excessive wear, and is giving a specific fuel consumption as low as 200 grammes. It is expected that fuel consumption will be even less with larger sizes.

An interesting development will be the use of four Wankel units coupled on the same power shaft as an in-line engine. Whilst it may not be possible to keep the length of such an engine down to that of the conventional four, the centrifugal forces will be automatically balanced if the four eccentrics are set at 90 degrees apart. The free couples would be balanced in the conventional way.

(Continued on Page 125)

SIMPLE AIR LEVITATION CRAFT

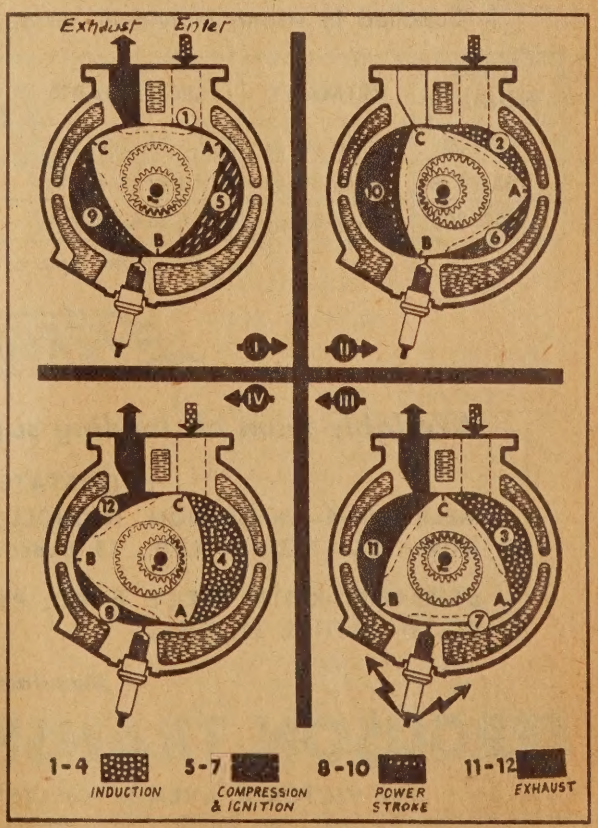


The cushioncraft is the latest air levitation vehicle. It is lifted about one foot by the large turbine ring rotated around its outer periphery. Drive is through a motor car type and wheel engaging a track on the turbine annulus. It is propelled by two steerable propellors driven from the same small engine.

☆

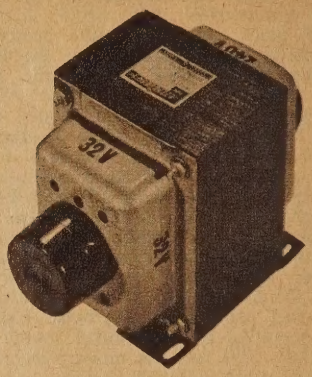
The Wankel rotary piston engine comprises a triangular rotor orbiting clockwise in an epitroichoidal casing. Reading the drawings in a clockwise direction the induction stages are shown by numerals 1 to 4, the compression stages as 5 to 7, with ignition as the last stage. Figures 8 to 10 show the power stages and 11 and 12 the exhaust.

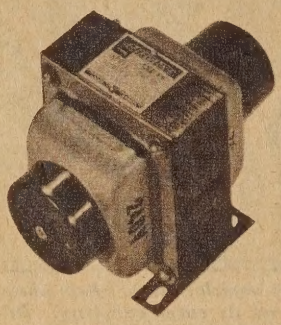
☆



FERGUSON

APPROVED





240 TO 32 VOLT STEP-DOWN TRANSFORMERS

For 32 volt safety lead lights and small 32 volt tools or appliances in the home, garage or factory.

- Fully approved to S.A.A. specifications. No. C126-1950 Approval No. N158
- Available in 3 sizes—60 V.A., 125 V.A., 200 V.A.
- Double wound—32 volt winding completely isolated from mains
- Double insulated—tested to 2500v 50 cps between windings
- Approved 240v 3 terminal cord-grip bakelite input connector
- Standard 2 flat pin bakelite outlet socket
- Fitted with metal covers and mounting feet for wall or bench mounting
- Attractively finished in grey hammertone and black
- Supplied in strong individual cartons

TYPE NUMBER	PRIMARY	SECONDARY	Overall dimensions—inches			APPROX. WEIGHT
			HEIGHT	WIDTH	LENGTH*	
TS32/60	240v-50cps	32V-1.9A-60-V.A.	3¾	3⅛	5¾	4¾ lbs
TS32/125	240v-50cps	32V-3.9A-125V.A.	4½	3¾	6¾	9 lbs
TS32/200	240v-50cps	32V-6.25A-200V.A.	4½	3¾	7½	12½ lbs

* Length includes input connection and outlet socket.

FERGUSON

Available from all leading suppliers throughout Australia

INTERSTATE AGENTS:

MELBOURNE—McKINNON NICHOLLS PTY. LTD., 468 Collins St. MB1501
ADELAIDE—TYQUIN LTD., 13 Deacon Ave., Richmond, 57-8153, 57-8154, 57-7887
BRISBANE—KEITH PERCY & CO. PTY. LTD., 179 Elizabeth St., 2-1757
PERTH—ATHOL M. HILL, Durham House, 842 Hay St., 21-6987

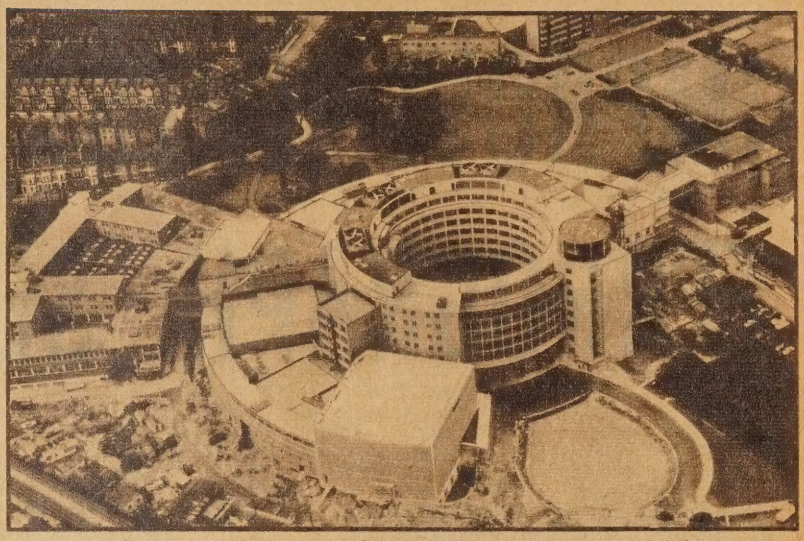
Manufactured by

FERGUSON TRANSFORMERS PTY. LTD.

411 VICTORIA AVENUE, CHATSWOOD, N.S.W. PHONE JA 8491

NEW BBC TELEVISION CENTRE

The new BBC Television Centre at Shepherd's Bush, recently brought into operation, is claimed by the BBC to be one of the finest in the world. Designed to cater for future as well as present use, the building is at the same time functional and architecturally pleasing. The following summary is intended to give some idea of the scale of this latest TV undertaking.



An aerial shot of the new BBC Television Centre at Shepherd's Bush. The Scenery block is on the extreme left and the restaurant block on the extreme right. The studios radiate outwards from the central ring.

SPEAKING of the new building at a recent Press conference, the Director of BBC Television, Gerald Beadle, C.B.E., said:

"I want you just for a few minutes to think of it as an industrial building —a factory—the largest, best equipped, and most carefully planned factory of its kind in the world. Its function is to produce about 1,500 hours per anum of electronic program material for television. This is a very big output for a single unit. In terms of sheer quantity it is the equivalent of one thousand full length feature films."

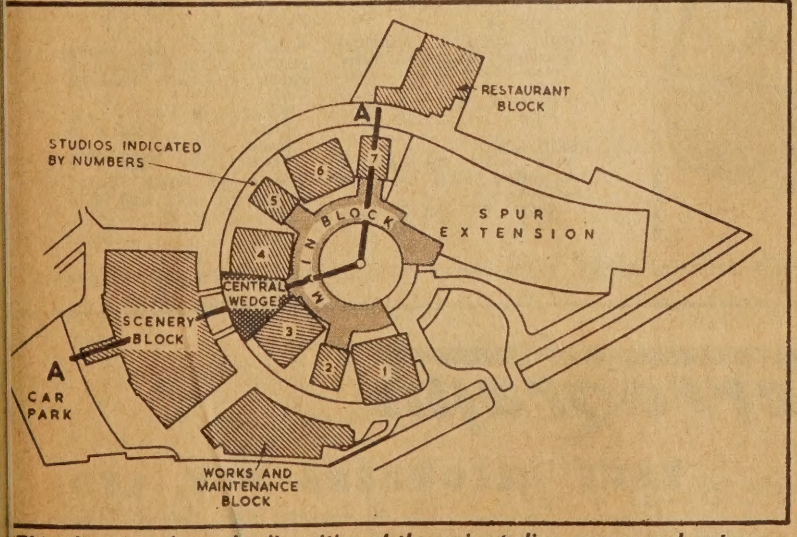
The New Centre, in Wood Lane, Shepherds Bush (some four miles from the centre of London) has been specifically designed for the special requirements of television. Its studios are the first the BBC has had which have been designed and built expressly for the production of television programs; all other BBC studios in London and the Regions have been adaptations of existing buildings.

The conception of the Centre is preminently practical; a circular Main Block houses the technical areas and the equipment directly associated with the production of television programs, the transmission of films and telerecording. Here, too, are the facilities for artists, such as dressing-rooms, make-up and wardrobe and also the administrative offices. Grouped round this circular building are the studios; this arrangement well meets the technical requirements and provides easy access from the centre for staff and artists.

Around the outside of the studios (the studio floors are at ground level) runs a covered carriage-way for the transport of scenery to and from the outer ends of the studios; the scenery is built and stored in a separate Scenery Block situated on the outside of the carriage-way. The ease and speed with which scenery can be taken into and out of the studios is of the utmost importance because it is a major factor in controlling the amount of use that can be obtained from a studio.

A Restaurant Block, also situated on the outside of the carriageway, is an essential amenity; similarly, the Works Block (not yet constructed) will be the centre for engineering and house service maintenance, some stores and offices and a suite for experimental television. It is now being planned and building will commence next year. Eventually, a "spur" or "tail" running from the Main Block is planned.

In designing the Centre, care has been taken to look well ahead and to provide space for possible future developments, such as colour and a second program. This will make it possible, when the time comes, to install the additional electronic equipment, lighting and ventilation plant without any major building work. Space is available on the site for further future development should it be found, for example, that additional studios are required.



This plan view shows the disposition of the main studios, scenery and restaurant blocks, etc. Administrative offices are housed in the inner ring overlooking a central garden, complete with decorative fountain. Note the spur extension planned for the future.

HUGE OUTPUT

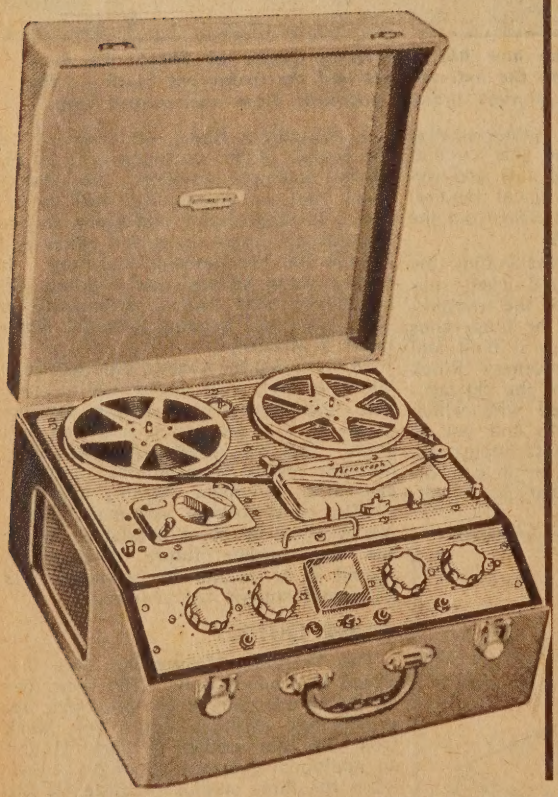
The Television Centre has been designed to produce some 1,500 hours per annum of television studio programs; approximately eighteen hours per week from the four studios in Stage II and an additional fourteen hours per week when the three studios in Stage III are equipped later.

A great deal of thought has gone into the planning of the operational control areas associated with each of the studios to enable the high standards of production and of technical and artistic picture quality set by the BBC to be maintained.

Control Rooms for Vision, Lighting, and Sound lie behind continuous plate-glass windows extending across the inner end of each studio and behind these are the Apparatus Rooms.

A departure from established practice is the provision of a vision control console alongside the lighting control console. It is based on the principle that

8 IMPORTANT DESIGN IMPROVEMENTS IN NEW FERROGRAPH SERIES 4



This latest development of the incomparable Ferrograph incorporates several new design improvements and will enable every Series 4 Ferrograph to be readily adapted at any future time for a variety of applications. For example, space has been provided under the Head Cover to permit Head changes and additions for monitoring, stereo playback and for lower track uses. Such heads are designed to be plugged in and are fitted with rocking facilities for azimuth correction.

Also, this new development permits any Series 4A to be instantly converted to a Series 4S merely by plugging in the additional stereo head.

Other important design improvements are:

- The capstan motor is resiliently mounted for quiet operation.
- Function Switch Knob is re-fashioned for greater ease of operation.
- Brief Stop is now a standard fitting on all Ferrographs.
- The Head Cover—a one-piece moulding—is hinged for easy tape loading.
- The Turns Counter—now gear driven—is accurate to a turn.
- New standard colour scheme for all models—2-tone grey.

SERIES 4A
With standard monaural recording/playback facilities.
Model 4A/N 3¾/7½ i.p.s.
Price £239 2 6
Model 4A/H 7½/15 i.p.s.
Price £271 12 6

SERIES 88
With full stereophonic recording and playback facilities.
Model 88 7½/15 i.p.s.
Price £302 7 6

SERIES 4S
With optional stereo sound playback facilities in addition (when used with Stere-Ad Unit).
Model 4S/N 3¾/7½ i.p.s.
Price £268 0 9
Model 4S/H 7½/15 i.p.s.
Price £289 1 0
Stere-Ad Unit (when required) £90 9 0

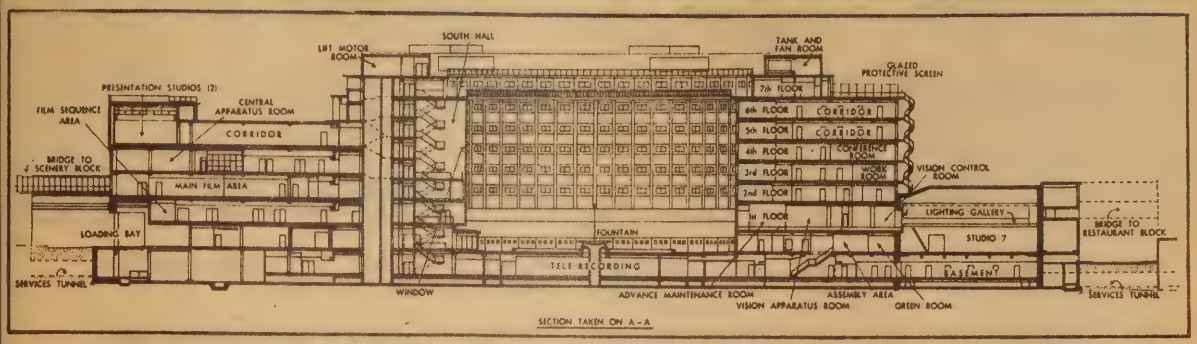
PRICES QUOTED ARE RETAIL. TRADE PRICES EXTENDED TO BROADCASTING INTERESTS.

THE INCOMPARABLE **Ferrograph**

Demonstrations and supplies available from: **TAPE RECORDERS PTY. LTD.**
60 Clarence Street, Sydney. BX 1571

PLEASE WRITE TO US FOR FULL DESCRIPTIVE LITERATURE AND NAME OF YOUR NEAREST DISTRIBUTOR AND SERVICE AGENT

BBC TV CENTRE—OFFICES, WORKROOMS, STUDIOS



A sectional elevation taken on "A-A" of the plan on the previous page. One studio (No. 7) is visible in this drawing, all the others being similarly placed around the main building on the same level. Conference rooms, smaller work rooms, and main offices are shown in the central ring section.

he operational staff responsible for the etting and control of the lighting of the tudio scene and for the control of the amera exposure and the resultant video ignals should be close together and view the same picture monitors.

It has been proved possible by a comprehensive series of experiments for one operator at the vision control console o control electrically all the cameras n a studio, which may be as many as ix. This has been achieved, first by rranging the controls and picture monitors in such a way that the minimum f effort is required by the vision control supervisor and secondly by designng the cameras and their associated ontrol equipment for remote control.

CAMERA STABILITY

This necessitates a very high degree f electrical stability, but it has been roved that an image orthicon camera hannel can be used in this way with only wo operational controls—one varying he light input, by means of a remotely ontrolled iris, and the other the picture lack level. The remaining controls, umbering about thirty, are pre-set in dvance. The specifications issued by the BBC for the camera equipment required hat this stability was to be achieved.

The operational controls in the vision ontrol console have been specially deeloped to enable three functions to be erformed with a single control. Moving he control over a quadrant varies the ens aperture. A knob on the control s rotated to adjust the picture black evel and pressure on this knob will witch a single monitor from one camera o another. Each camera has, as usual, s own picture monitor and this last acility enables the pictures from each f the cameras to be displayed in turn n a single pre-view monitor so that the ictures can be accurately matched, liminating possible differences in inividual monitors.

Each studio camera incorporates a 4in image orthicon pick-up tube. Turret ounted lenses provide nominal horiontal viewing angles of 9 degrees, 16 egrees, 24 degrees and 35 degrees. lewly developed studio zoom lenses are lso available; they are turret mounted nd cover horizontal viewing angles in he range 9-32 degrees.

The production lighting installation at he Television Centre follows, in the ain, the general principles satisfactorily ioneered in the Riverside Studios. Electric hoists are used for the raising and lowering of lamps and a comprehensive dimmer system gives intensity control and switching of every studio light source from a centralised control desk.

The principal innovation is the introduction of luminaires which can be panned, tilted and focused by means of a pole from the studio floor. This system has been developed by the manufacturers at the instigation of the B.B.C. and should further reduce the amount of time taken for the final adjustment of the pattern of light which the lighting supervisor wishes to achieve.

The lighting hoists are designed to carry a load of 250lb at 30ft/min. on a length of aluminium alloy tubing 8ft 8in in length. Each such tube has two self-coiling cables wrapped round the two supporting wire ropes, each cable carrying two 2-kW circuits. Additional scaffold tubes can be suspended from each hoist, or a pair of hoists, so that a single unit could carry six or more luminaires.

All dimmers are autotransformers and the remote control system is by electromagnetic clutches. All the studio lighting circuits are wired back to the dimmer room where a large patch cord panel enables any circuit to be connected to any available dimmer channel. As previously, every production lighting circuit has available a dimmer channel in order that the dimmer control system may be used, not only for lighting changes for effects purposes, but for the adjustment of intensity of any luminaire for picture quality control.

LIGHTING CONTROL

The lighting control desk provides very flexible control facilities, including 20 memory combinations to enable the lighting supervisor to do the majority of his lighting changes on transmission at the touch of a single control. The desk incorporates a mimic diagram showing the state of dim of every lighting control channel.

Alternating current is used for the studio production lighting and each studio has a 240V single-phase power supply. Provision has been made for a lighting load of 200 kVA in the larger studios and proportionately less for the smaller ones. Provisions has also been made for trebling this capacity by conversion to 3-phase working, to meet possible lighting requirements for colour television.

The centre consists essentially of a large circular main building with three surrounding blocks—scenery block, restaurant block, and works block—radiating from it; and a future spur to be attached later to its northern end. This spur will complete the composition within the pattern of the internal roads and can be planned either as a large extension to the main block or as one or more separate entities.

The main building is approached from a colonnade which rises above a forecourt between it and Wood Lane. It contains a series of studios, with wedges between them, radiating from a high ring set around a central garden. The outer ends of the studios are linked by two arms of a runway carrying the scenery and properties which are brought under hoods from the adjoining scenery block. Between these two arms, a loading bay in the central wedge handles the delivery and dispatch of all other goods.

CONVENIENT LAYOUT

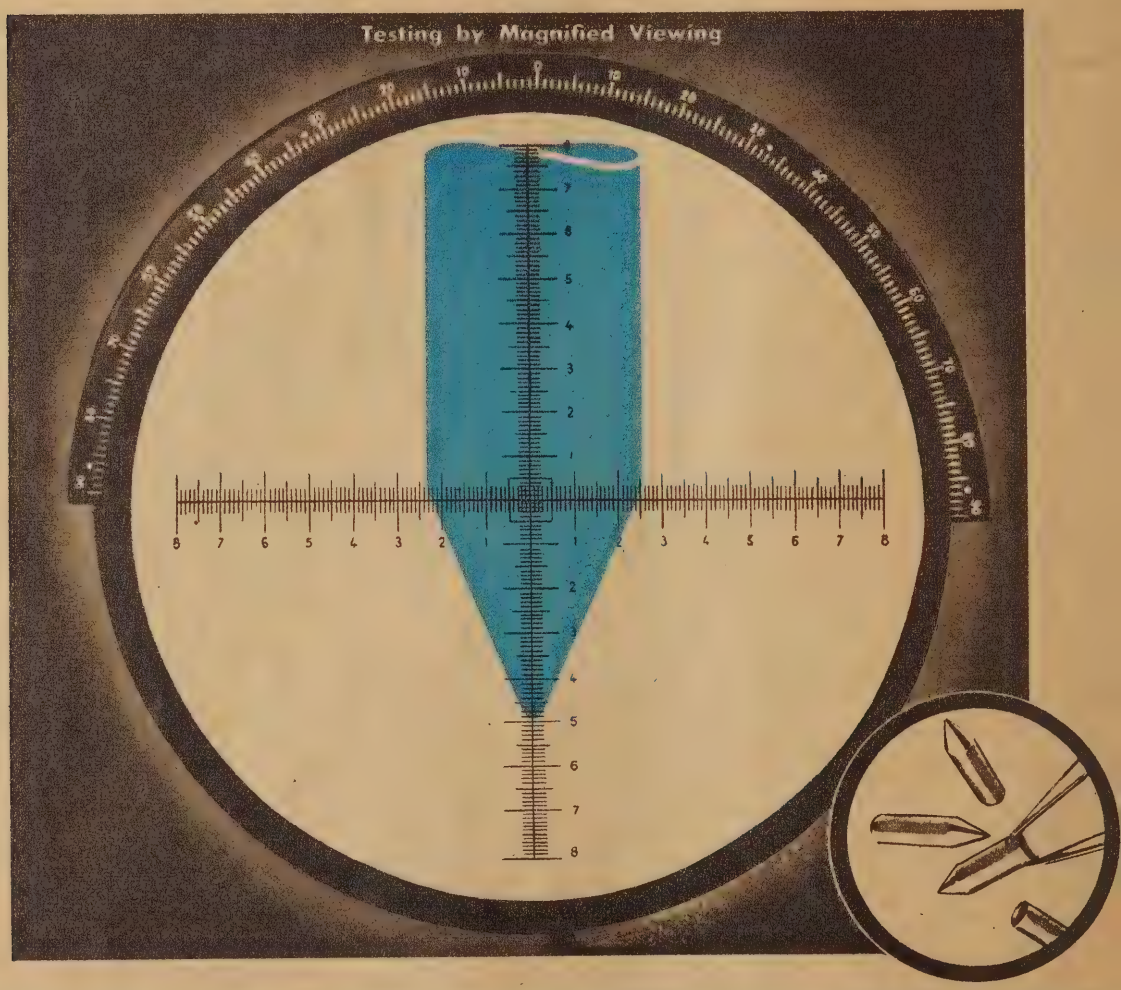
As a result of this layout, people, who are mainly concentrated within the various levels of the ring and reach the studios by entrances at their inner ends, are segregated from the bulk movement of goods and need only walk comparatively short distances; whilst scenery and properties are carried by trolleys which readily cover the much greater distances around the perimeter.

The outer diameter of the main building, which at basement level covers 3½ acres, is 500 feet. The departmental and administration offices contained in the upper floors of the ring look either on to the central garden or over the sound-resisting boxes which form the studios; they can therefore enjoy natural light and air without suffering discomfort from excessive noise. A further advantage of this layout is that it produces a building mass of which the highest element is in the centre.

During the ten years or more since November, 1949, during which the buildings have been planned, replanned, and built, a number of particular problems related to a new conception have been faced; hundreds of man-years have been spent on design and many more on erection. Achievement is due to the sustained enthusiasm over this long period and to a high level of co-operation by all concerned: committees and departments of the B.B.C., authorities, design teams, contractors and suppliers. In spite of unavoidable delays, changes, and frustrations, it has been a worthwhile job.

SAPPHIRE EKCo DIAMOND NEEDLES

PERFECTION IS OUR ONLY PASSWORD



- Stylus is backed by over a quarter-of-a-century of precision manufacture.
- Stylus Radiogram Needles are Australian-made and fully guaranteed.
- Stylus are available from all reliable retailers.

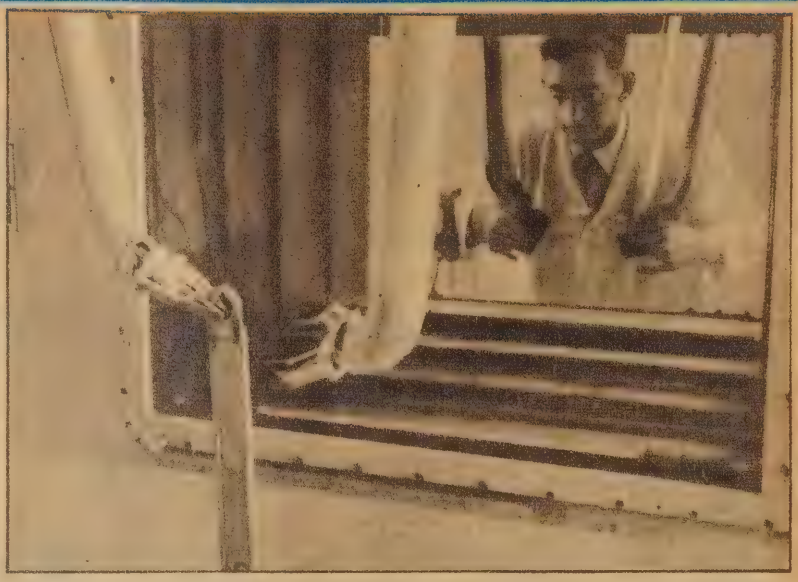
Use only EKCO-STYLUS—the Brand name that stands behind its products.

TRADE ENQUIRIES: **ERNEST KUENZLI PTY. LTD.**

60 HUNTER STREET, SYDNEY. BW 6991.

ISOTOPES SOLVE MANY PROBLEMS

We hear a good deal about isotopes these days; how they are being used in industry and medicine to achieve results which, a few years ago, would have been either prohibitively expensive or completely impossible. This article, supplied by the Petroleum Information Bureau, gives an excellent insight into some of the amazing jobs now being performed by this latest product of the atomic age.



Isotopes are undoubtedly one of the most versatile products ever offered to science and industry, their potential being but dimly foreseen at this stage. Many require to be handled with special care by means of remote handling equipment as shown here.

RADIO-ISOTOPES are the atomic age's peaceful gift to industry. They are industry's "sixth sense," capable of uncanny feats of perception.

Scientists and engineers predict that the use of radio-isotopes in Australian industry will begin to rise spectacularly this year. And overseas experience points to the petroleum industry being the biggest user.

One reason for this expected fillip to isotope use is the announcement by the Australian Atomic Energy Commission a few months ago that it would accept orders for industrial radio-isotopes produced at its Lucas Heights reactor. Until now, industries that wanted isotopes had to import them from the U.S.A. are Britain.

OVERSEAS EXAMPLE

Another reason, and perhaps the most important of all, is that Australian industrialists have seen the dramatic benefits which industry overseas has achieved from the use of isotopes—benefits in the form of revolutionary methods of inspection, control and manufacture; of speedy and accurate analysis, and highly sensitive testing. These and other results of isotope application have solved many long-standing and difficult industrial problems.

This industrial awareness in Australia has been slow to develop, but a few companies have been very far-sighted, and one at least has set up a special division to advise on the application of radio-isotopes—the first commercial consulting service of its kind in Australia.

Radio-isotopes are radioactive forms of elements. They can be solids such as iron or sulphur, gases such as hydrogen or krypton, and liquids as varied as water, acids and solvents. Some radio-active substances occur naturally, but for practical use they have to be produced artificially. This can be done by bombarding substances with neutrons in an atomic reactor.

These radio-active substances emit rays which have unusual properties—some different from others. Rays from some can penetrate almost any material, including steel inches thick. Rays from others can destroy bacteria, or trigger chemical reactions which would be impossible to achieve by other means.

MEASURING THICKNESS

Used with electronic devices, such as a geiger counter, they can gauge dimensions that cannot be measured physically —for instance, the wall thickness of a sealed container. They can detect impurities in substances in quantities as small as one part in several thousand million. They can reveal densities and moisture contents of solids and fluids. They can trace hidden objects. They can measure the components of complex mixtures without the need for sampling and chemical analysis. And they can do all these things with astonishing speed and accuracy.

Gauging provides one of the simplest examples of how industry uses isotopes. If we wanted to measure the thickness of a sheet of paper, we could place a radio-isotope on one side and a radiation counting device on the other. The rays from the isotope would pass through the paper, and the counter would tell us how thick the paper was, rather like a radar set tells us distances.

Of course, we could find out the thickness of the sheet by physical means, such as by careful measurement with a micrometer gauge. But the value of the isotope method is apparent in continuous process industries, such as the manufacture of paper or plastic sheeting which is coming off the mills in a continuous strip at high speed.

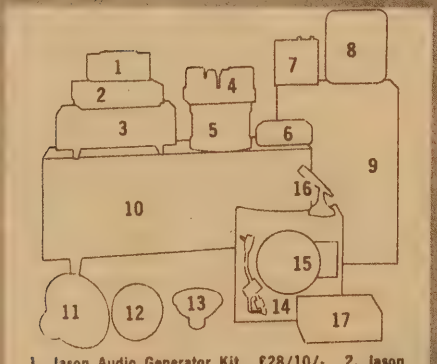
The isotope rays and their detectors, without touching the paper or plastic, can give us a continuous measurement of its thickness. We do not have to stop the machines to get this measurement, neither is it only at intervals of so many feet, as would be the case using physical gauging.

ODD USES

This has led to some odd but valuable uses of the isotope method of gauging. Overseas, some manufacturers are using it to check the thickness of paint film, and have reported savings of up to 30 per cent — quite a big saving for a factory that may be turning out hundreds of thousands of painted articles a year.

In the higher forms of endeavour the Americans have used the same method

Isotopes and typical industrial applications: At left, perspex made with radio-active carbon 14, and alongside it foil containing strontium 90. Then comes a radium needle and a capsule of caesium 137. Note the size relative to the florin.



1. Jason Audio Generator Kit. £28/10/-. 2. Jason 20 watt Stereo Amplifier. 85 gns. 3. Pioneer 17-watt Stereo Amplifier with AM/FM tuners. £149. 4. Quad Power Amplifier. £61/5/-. 5. Axiom 80 Free-Edge Speaker. £36/14/-. 6. Quad Stereo Pre-Amp. £64/15/-. 7. Fi-Cord Hi-Fi Transistor Tape Recorder. £121. 8. Tandberg Model 5 Four-Track Stereo Tape Recorder. £266. 9. De-luxe Vented Enclosure for Tannoy Monitor Speaker. 29 gns. 10. "Horizon" Stereo Speaker Cabinet in single unit. Holds two 8" speakers. £28/10/-. 11. Tannoy 12" Monitor Dual Concentric Speaker. £78/10/-, incl. X-over. 12. Peerless 820/20 8" Co-Axial Speaker. £15/8/8. 13. Goodmans Axiette 11 8" Wide Range Speaker. £16. 14. S.M.E. Model 3009 Precision Pick-up. £39/17/6. 15. Rola Professional Turntable. Synchronous motor. £76/8/10. 16. Grampian DP4 600 OHM Dynamic Microphone. £20/3/-. 17. Myer 10-watt Integrated Stereo Amplifier. 50 gns.

The history of High Fidelity is a series of adventurous explorations in expanding the existing boundaries of musical and engineering limitations, of developing effective techniques and equipment for capturing and reproducing every known variety and nuance of tonal colour and dynamics. The world's finest high fidelity, stereophonic sound reproduction equipment, together with unmatched facilities for auditioning and comparing this equipment is available to you only at Mastersound.

MASTERSOUND

400 Kent Street, Sydney. BX 2977

(around the corner from Market Street)

Mail this coupon for full particulars of equipment illustrated on this page.

Mastersound, 400 Kent Street, Sydney.
Please forward further details re No.....
NAME.....
ADDRESS.....
STATE

o measure the wear on their space atellites caused by the abrasive effect of particles high above the earth's surface.

Another use of radio-isotopes is finding hidden objects. A big department store overseas uses them in the system of pneumatic tubes which carry dockets and money between the counterhands and the cashier's office. Each of the containers is "labelled" with a very small piece of radio-active substance. If a container becomes jammed in a tube it can be quickly located by scanning along the outside of the tube with a geiger counter, which will pick up the radiation given off by the isotope inside.

These, of course, are very simple examples. In countries more industrially developed than Australia, factories are using radio-isotopes in highly complex operations, and their use is growing rapidly. Many are using them in conjunction with automatic controls and are achieving impressive quality standards, production outputs and cost savings.

AUTOMATION, ETC.

Automatic control, in its simplest form, is a mechanism that compares what a machine is doing with what it s required to do, and corrects it when necessary.

Going back to the example of the process of making paper or plastic sheeting: let us assume a machine is required to produce a strip .001in thick. We instal an isotope gauge and link it to an automatic control. The gauge measures continuously the thickness of the material as it rolls off the machine and signals this information to the control. If the thickness varies from .001in by more than the tolerance we have allowed (it might be only .00005in either way), the control will automatically adjust the machine to bring the material back to its proper thickness.

Of the many industries using and developing radio-isotope methods overseas the oil industry is the undisputed leader. And this will almost certainly be the case here, too. This is easily understood when we consider the vast range of products and by-products of petroleum.

The petroleum industry is using isotopes right along the line, from oil search, through the refining processes, storage and transportation, to end-use research and development.

Oil geologists are using isotopes to analyse soil and rock for oil-bearing formations. Drilling teams are using them in the form of "bullets" lodged in well casings. These become accurate depth markers when detectors are later lowered into the wells.

EFFICIENCY CHECK

Another use in oil wells recently was to test the efficiency of a process which oil engineers have used for years to force oil out of a partially depleted oilfield. This involves pumping natural gas under high pressure into one or two of a group of wells. The gas builds up pressure underground and forces the oil up surrounding wells.

The engineers wanted to know how much of the gas pumped into the wells was doing the job, how much was escaping through cracks in rocks, and how much was passing over the oil and escaping up other wells. They mixed minute radioactive particles with the gas and took daily samples of gas emerging from a number of wells in the field. Analysis of the samples gave the engineers the information they wanted.

Radio-isotopes probably make their greatest contribution to the oil industry in the refining processes. Often two or more completely different fluids are dispatched along a pipeline, each intended for a different destination in the refining plant.

DETECTS BATCH

Technicians "tag" the head of each flow with a small quantity of isotope. At appropriate points along the pipeline they place detectors. When the fluid, pushing its isotope ahead of it, reaches its detector, the rays convey the message that it has arrrived at that point. The detector warns an operator, or signals an automatic control, to turn a valve, and the fluid is switched to its right destination.

In an American oilfield one pipeline carries the oil from several different oil companies' wells. Isotope gauges installed on the pipeline 700 miles from the oilfield enable each company's oil to be directed to its proper destination.

Another method, which does not require "tagging," is to install an isotope gauge outside the pipe. The rays pass through the pipe and measure the fluid's specific gravity. Knowing the specific gravity of each fluid travelling along the pips it is thus a simple matter to identify which fluid is passing the gauge.

There are many other applications of radio-isotopes in the petroleum industry, such as measuring catalyst flow rates in catalytic crackers, checking and controlling the mixing and blending of liquids and gases, and gauging the height of fluids in tanks. Often these applications are safer for plant operators and easier to instal and maintain than conventional methods.

In end-use research a time-and-money-saving use is the measurement of engine deposits. Ordinarily it is a long and costly process to determine the effects of various fuels and lubricants on engine deposits. An engine is run for many hours, then stripped down and the deposit removed and weighed.

Also, it is often important to know the effects of cold engine starts. As an engine remains cold for only a short while after starting, these effects can best be studied by using a short-duration testing procedure.

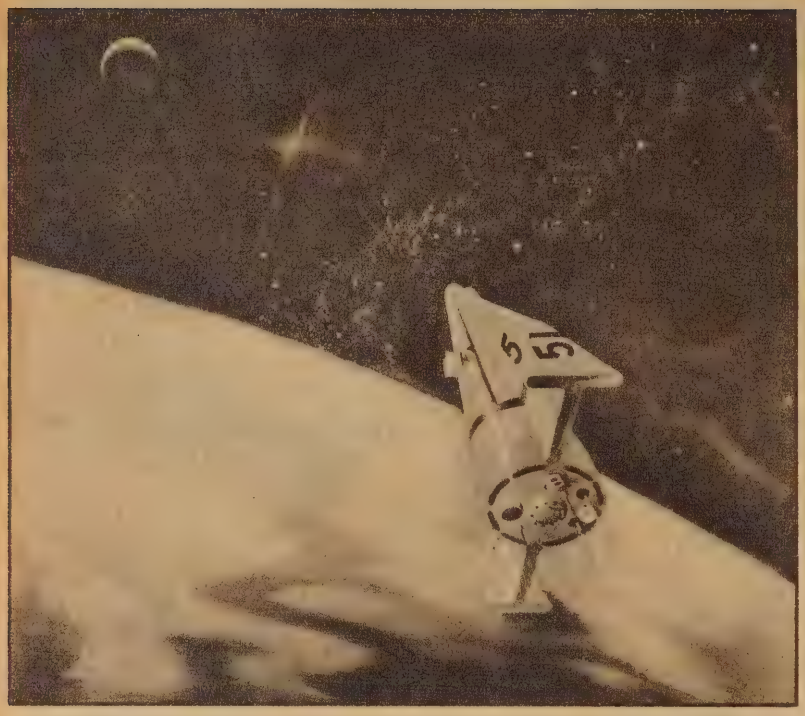
ISOTOPE METHOD

The new method is to coat the areas where deposits are likely to occur with a radio-isotope. After the engine has run a comparatively short while, the deposits—even if they are in minute quantities—can be measured with a sensitive radiation counting device. A similar process can be used to measure engine wear.

These are only some of the uses of the remarkable isotopes. The next few years will probably see the extension of these methods to control whole processes —from the introduction of the raw material to the packaging of the finished article.

TYPICAL JOB FOR AN ISOTOPE

Set-ups such as this are becoming more and more common as industry realises the vast potential of the radio-active isotope. Here a consultant on the industrial application of isotopes demonstrates the measurement of radio-activity with a radiation counter.



An artist's impression of a ferry craft such as might be used to build and man a space base in orbit around the earth. While a lot of effort is being expended on such research, scientists emphasise that there is still a long way to go before such dreams become fact.

Journeys in Space—Fact or Fiction?

There has been an abundance of literature dealing with rockets, satellites, and space ships, much of it written in highly technical terms. Alternatively, "simplified" versions leave a good deal to the imagination; something which is apt to fail us when dealing with anything as vast as the universe.

by Calvin Walters

OTHER literature has been written by newspaper and magazine correspondents who inevitably in their own enthusiasm colour their reports with, at times, highly speculative theories and forecasts of the possibilities of space travel in the future.

It is inevitable, therefore, that many inaccuracies have crept into such accounts and this has led to some confusion in the minds of the so-called lay public.

Such circumstances inspired the United States Congress to have printed a special report, in the form of an authoritative study in lay terms, which set forth clearly the present and definitely foreseeable state of the art of space flight. This report is entitled "Space Handbook: Astronautics and its Applications. Staff Report of the Select Committee on Astronautics and Space Exploration."

This book of some 252 pages is a most interesting document which contains much that is essential to the layman for a clearer understanding of the techniques required for the launching of satellites and space vehicles, together with details of the applications of astronautics for the betterment of life of mankind.

There is a difference in the meanings of the terms Aeronautics and Astronautics. The former deals with flight through the atmosphere while the latter deals with flight through space.

One of the first questions which comes to the mind of the layman is "What is the value to us of the launching of a satellite or the exploration of space?" The Select Committee very neatly lists the opportunities which are of importance as follows:

Carry scientific instruments out of the atmosphere and away from the earth's magnetic field to permit greatly improved observations of remote regions of space, to advance basic understanding of some of the great fundamental questions about the nature of the universe and its large-scale processes.

Carry scientific instruments, and eventually people, to the planets and other bodies in the solar system for direct exploration of their physical nature and, perhaps, indigenous life forms.

Permit studies of behaviour and evolution of terrestrial biological specimens in environments grossly different from those on earth.

IMMEDIATE ADVANTAGES

Enhance understanding of the physical properties of the earth by viewing it from the vantage point of space to supplement surface observations.

Provide meteorological observations of global scope to improve understanding of weather processes, with a long-range hope of not merely better weather forecasting but eventually of some form of weather control.

Provide useful navigation beacons with global coverage independent of weather and time of day.

Provide large-scale radio broadcasting facilities, long-range point to point communications without elaborate and slowly constructed ground facilities; reliable communication at low power levels with fixed or vehicular stations; and point to point communication over long ranges at low power levels to conserve the already overcrowded frequency spectrum.

Conduct detailed military reconnaissance of vast areas in a short period of time.

Conduct international inspection of vast areas in a short period of itme.

Make possible various forms of interference with military attack-warning systems.

Deliver nuclear weapons from remote regions of space.

It will thus be seen that the possibilities attendant with satellites and space vehicles could have a vast influence on the future way of life of human beings of this or any other planet.

The possiblities of space flight are dependent on the progress made in the making of Intercontinental Ballistic Missiles for military purposes for it is by means of the "hardware" associated with these that it is hoped to eventually launch a vehicle into space, and return it to earth.

In most literature about space one frequently finds technical terms which are not always explained but which are nevertheless necessary to clearly understand the art of space flight.

Take for instance the terms "trajec-

tory" and "orbit." These can be quite confusing. Both terms refer to the path of a body in space. Trajectory is used in connection with projectiles and is mostly used where the path of the projectile has clearly defined starting and end points. We refer to the path of a projectile from the earth to the moon as a trajectory.

The term "orbit" is usually used in connection with paths which are mostly indefinitely extended or paths which are repeated such as the orbit of the moon around the earth.

The basic types of paths in space are determined by the gravitational attraction of masses in space. This gravitational influence of a concentrated mass results in different types of paths which a vehicle may take. Fig. 1 is reproduced from Soviet Russia's "Interplanetary Travel." This shows, in (1a) an "elliptical orbit" made familiar by the artificial earth satellite. This orbit is closed on itself and a satellite or vehicle on this orbit would traverse it repeatedly. In the figure (Ib) is a "hyperbolic orbit" which is the kind that would commence an interplanetary flight. This orbit is open and extends into infinity.

PARABOLIC ORBIT

Between these two orbits is a special one called a "parabolic orbit" which is a sort of half and half orbit between vehicles that are tied to paths in the general vicinity of the parent planet and those which take up open hyperbolic paths to distances remote from their parent planet.

We now come up against two more terms which need clarification. These are "orbital velocity" and "escape velocity."

Orbital velocity is the velocity required to keep a vehicle suspended above a planet so that it travels a continuous path around the planet without falling.

Escape velocity is the velocity required to enable a vehicle to escape entirely from the influence of the planet's gravitational pull and travel on into space.

Most of us have read from time to time that the "orbital velocity" required to keep a satellite circling around the earth is 18,000 miles per hour. Many have wondered how this speed is calculated and why it is necessary.

There is a law governing the rate of fall of unpowered objects which enables the scientist to calculate how long an object will take to reach the ground from various heights. It so happens that if an object, let us say an artificial satellite, is dropped vertically from a height of eleven miles, it will take just one minute to reach the ground and as the minute is a convenient time interval for our purposes we will stay on the eleven-mile level and see what happens under other conditions.

The laws governing these things also show that the rate of fall from a given altitude is independent of the speed at which an object may be fired in a horizontal direction.

Let us suppose that the satellite is fired in a horizontal direction from a rocket at our height of 11 miles. If it is fired at (say) a speed of one mile per second it will travel forward, gradually curving downward and hit the earth 60 miles away in a time of one minute.

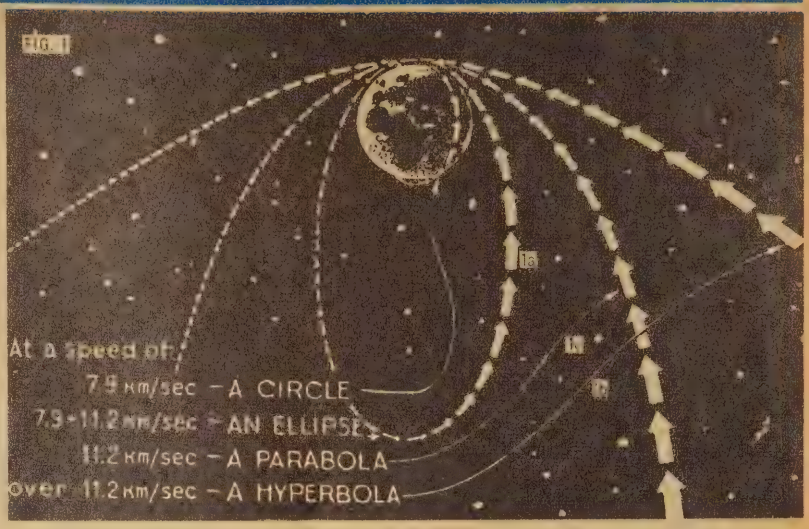
If we keep increasing the speed from 11 miles altitude we eventually reach a stage where the satellite is following a curve closely approximating that of the earth. At this speed the satellite will never reach the earth because the latter is falling away (or curving) at the same rate as the satellite is "falling" so that the latter is always 11 miles up after each minute of "fall."

300 MILES PER MINUTE

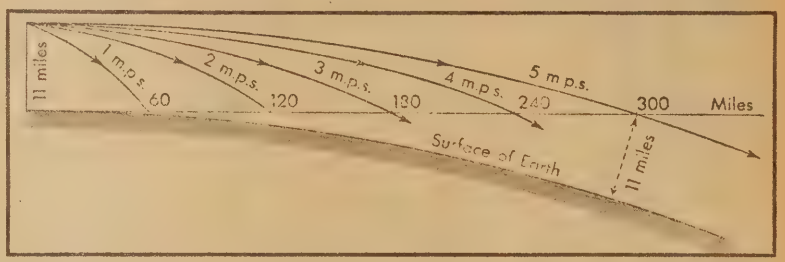
From a height of 11 miles the visible horizon is 300 miles away so that this is the distance one must travel before the earth's surface drops away 11 miles below the horizon. The satellite must therefore travel this distance of 300 miles in one minute which is a speed of five miles per second, or 18,000 miles an hour.

Arthur C. Clarke gives part of the above explanation in his excellent book "The Making of a Moon" in which he also gives an ingenious diagram which we publish here to make the understanding of the problem easier.

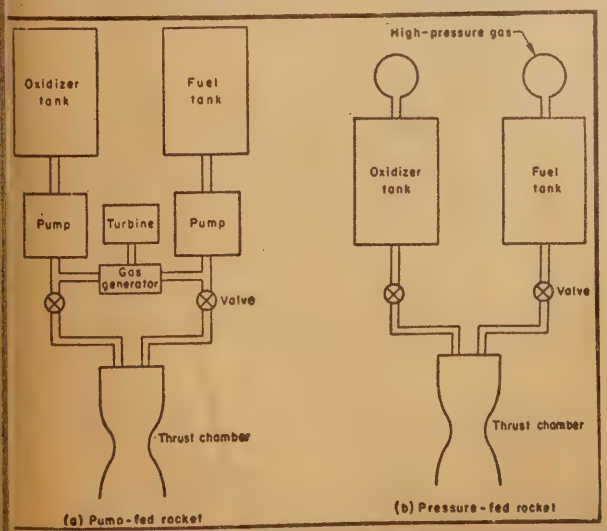
PUTTING A SATELLITE IN ORBIT



The various orbits which result from different values of escape velocity. A very precise value would be required to achieve a perfectly circular orbit and, in practice, satellites invariably assume a slightly elliptical orbit.



This simple diagram should help to explain the inevitable question, "What keeps it up there?" Once a sufficient velocity is obtained the satellite "falls" at the same rate as the earth's curvature. Hence, it will never approach any closer to the earth's surface.



☆

Simplified diagrams showing two forms of liquid propellent chemical rockets. At (a) is a pump fed rocket and at (b) a pressure fed type. The latter may be more reliable, but heavier.

☆

Dual

FOR PERFECTION IN MUSIC

DUAL 1006

SPECIFICATIONS

The DUAL 1006 will operate as a fully automatic changer, an automatic player or manually, as desired.

Pickup: The DUAL CDS420 stereo crystal cartridge plays both stereo and monaural microgroove records; frequency response 20-16,000 c.p.s. Styli are easily replaceable. (Separate cartridge assembly available if required for playing old style 78 r.p.m. records.)

Turntable: Large diameter, heavyweight turntable uses unique laminated and concentrically girded construction for positive retention of dynamic balance. This, together with self-lubricating ball-bearing assembly, provides virtually frictionless non-resonant rotation.

Motor and Drive: Four-pole motor with oscilloscope-balanced rotor set in highly polished self-centring bearings, eliminating vertical rumble. High permeability motor core eliminates hum. The multiple transmission drive with individual drive wheels for each speed has automatic retraction on completion of play, thus eliminating risk of "flat spots."

Tonearm: Lightweight one-piece construction eliminates tonearm resonance. Cartridge locks in position with built-in key. Double set of direct acting ball-bearings ensures complete freedom of vertical and lateral motion. Fingertip stylus pressure adjustment is conveniently mounted on tone-arm assembly. Patented roller-feeler guide in the tone-arm head enables the 1006 to index automatically with more care than the gentlest hand. Future record size innovations no worry to the owner of a 1006.

Built-in Pressure Gauge: A professional direct-reading gauge is conveniently located for instant check and adjustment of stylus pressure. Guesswork is eliminated, and record and stylus life prolonged.

Stereo/Mono Switch: Provides control of the stereo effect. The phase cancelling feed-back circuit removes vrtical noise signal from monaural records.

FRED A. FALK & CO. PTY. LTD.

28 KING STREET, ROCKDALE. Phone LX4783

It is not possible of course to have a satellite at such a low altitude because the friction of the atmosphere would soon slow it up and it would fall to the ground.

Nevertheless, for altitudes of some hundreds of miles the five miles per second orbital speed is still required. At much higher altitudes the orbital speed required becomes less, so that at a distance of the moon it is only 3,300ft per second.

For interplanetary space flight it is the "escape velocity" which must be taken into account. This velocity is really a measure of the difficulty of departure from the parent planet, and depends on the mass of the parent planet and the distance from the centre of planet to the space vehicle.

ESCAPE VELOCITY

We have seen that the orbital velocity of a satellite travelling round the earth is five miles or about 26,000ft per second. It requires only a small increase in velocity for the vehicle to break free from the influence of the earth's gravity and escape into space. The "escape velocity" from earth is about 36,700ft per second. Escape velocities from other planets are, from the Moon 7,800ft per second, from Mercury 13,600, from Venus 33,600, from Mars 16,700 and from the mighty Jupiter a staggering speed of 197,000ft per second is required.

Whether the vehicle will take a hyperbolic path or a parabolic path depends on its initial launching velocity. Velocities greater than escape velocities result in hyperbolic paths while lower than escape velocities result in elliptical or parabolic paths.

The launching velocity required depends on where you want to go. To give some idea of what is required, the Select Committee's Report lists the following minimum launching requirements to go to certain places and the time taken to get there as measured on earth. The first figure given is the minimum launching velocity in feet per second. The second figure, in brackets, is the journey time.

Mercury, 44,000 (110 days). Venus, 38,000 (150 days). Mars, 38,000 (260 days); Jupiter, 46,000 (2.7 years); Saturn, 49,000 (6 years); Uranus, 51,000 (16 years); Neptune, 52,000 (31 years); Pluto, 53,000 (46 years).

LEAVING OUR SYSTEM

If it is desired for any reason to get away from the Solar System you can do this by leaving the surface of the earth at a speed of 54,000ft per second. You will take up a parabolic path with the Sun at the focus and remain there probably until your course is deflected maybe centuries later by some star or other body.

The question has often been asked—what would happen to a man in a space vehicle if it travelled somewhere near the speed of light which is 186,000 miles per second? We have often read that if a man travelled through space at that speed and returned to earth maybe years later he would have aged very little by comparison with a man on earth. How does that happen? The Space Handbook gives the following account.

"As the velocity of a space vehicle nears that of light the effects of relativity enter into the situation. Of particular interest is the so-called 'time dilatation' effect predicted by this theory and supported by experimental evidence in the physics of high-speed particles.

"Briefly the predicted effect is as follows: Consider 2 men, A and B of identical age, say 20 years old. A stays at home. B goes on a voyage into space at a speed close to that of light and eventually returns to earth. The total duration of the voyage will be different as measured by the two men, the exact amount of the difference depending upon how close B's vehicle approached the speed of light.

"Suppose B took a trip to a nearby star. It would appear to A that the trip took say 45 years so that he would be 65 years old when his friend returned.

"To B, however, the trip might appear to have taken only 10 years, including a year or so for acceleration to flight speed and deceleration for the return landing. He would say he was only 30 when he returned. Different values of vehicle speed will lead to widely different time disparities. By approaching ever closer to the speed of light B could take more extended trips that would last millions of years in earth time but still appear to him to have taken only a few years."

It is not anticipated that the achievement of near light velocities will ever be achieved. The enormous amounts of propulsive energy required would demand nothing less than the complete conversion of matter into usable energy. Other problems associated with the environment of the traveller are at present insoluble.

Much has been written about the manner in which a rocket is propelled into space. It is well know that the usual procedure is to fire some kind of propellent either solid or liquid, forcing the resultant gases through a nozzle in a reverse direction to that which the rocket is to take.

The reaction force produced by expelling gases through a nozzle is called rocket "thrust." As the expulsion of material is the essence of thrust production it is obvious that no matter how much energy is available no thrust will be produced unless material is expelled.

Because of this the criterion for rating rocket performance is the "specific impulse" which is really an index of the efficiency with which a rocket uses its supply of propellent for thrust production.

Specific impulse is measured by the number of pounds of thrust produced per pound of propellent consumed per second. It is usually stated in terms of seconds. The higher the number of seconds the better the propellent.

Propellents can be solid or liquid and the best propellents in use today do not exceed specific impulses of more than 250 seconds. The aim, of course, is to produce some superfuel which can increase these ratings. Theoretically, hydrogen could give ratings of 1,000 or more seconds, but application of this is limited by the temperature limitations of the walls of the rocket engine.

Propellents are chemicals of two kinds, namely the fuel and the oxidiser.

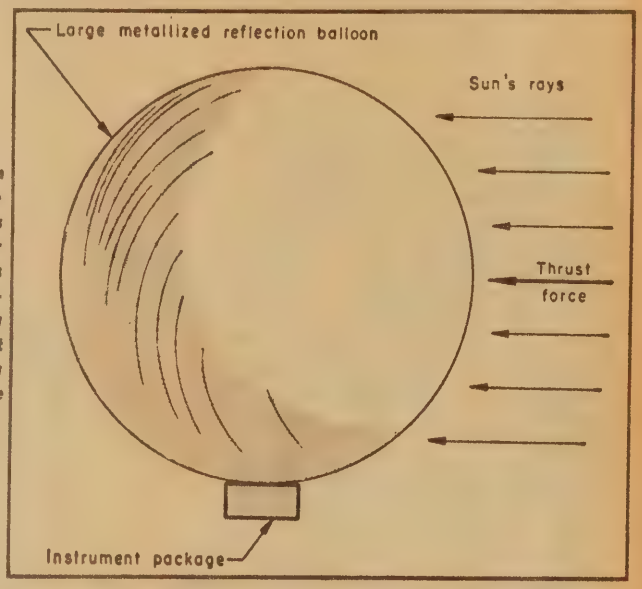
These correspond to the petrol and air in a motor car engine.

SOLID PROPELLENTS

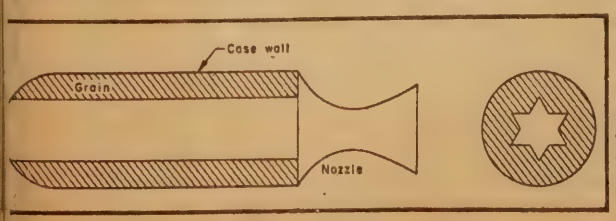
In solid chemical propellents the fuel and oxidiser are mixed and cast into a solid mass called a grain on the walls of the metal or plastic case with a hole left down the centre. The shape and dimensions of this hole affects the burning rate and therefore the thrust of the engine.

The fuel is ignited by a pyrotechnic

(Continued on Page 123)



This diagram demonstrates one of the schemes known as "Solar Sail." It uses "radiation pressure" resulting from radiant energy impinging on the large surface.



The solid propellant rocket. The "grain" is the fuel, cast in one piece inside the rocket casing. The shape of the central core controls the rate of combustion.

WE ARE A VITAL PART OF THIS PICTURE *BECAUSE* WE MAKE THE PICTURE TUBES

In a modern Television receiver there are literally hundreds of components, and each of them plays an indispensable part in keeping the set operating properly.

However, the one part that must be familiar to all television viewers is the Picture Tube itself. It is the heart of the set and distinguishes it from every other electronic device.

Since the inception of Television in Australia, the huge demand for Picture Tubes has been met mainly by the Amalgamated Wireless Valve Company, for 25 years Australia's leading electronic valve manufacturer. This Company now manufactures the following Picture Tube types to meet the strict requirements of the latest television advances:—

17" Electrostatic Focus	21" Electrostatic Focus	23" Electrostatic Focus
17HP4B	21CBP4A	23MP4
17BJP4	21CEP4	23CP4
17BZP4	21DAP4	

AMALGAMATED WIRELESS VALVE COMPANY PROPRIETARY LIMITED

AWV

SYDNEY — MELBOURNE — BRISBANE

Technical Review

OPTICAL POLISHING AND MATING SEALS VALVES

The idea of a mechanical glass seal so precise that it will maintain the vacuum in a radio valve may sound fantastic at first hearing, yet valves using this technique as a temporary seal during manufacture are now in experimental quantity production. What is more, valves made by this method appear to be better than those made by conventional techniques. This story, from Radio Electronics, tells how it is done.

A NEW, yet old method of joining the two glass parts of a valve (envelope and stem mount) has been demonstrated by the Chatham Electronics Division of Tung-Sol. It is based on the principle that if two glass surfaces are highly polished and mated they will hold together because of molecular attraction. Originally, some attempts were made to make airtight seals by using such accurately polished and mated surfaces that true molecular bonding resulted.

The story goes that this process was

Precision polishing of the bulb which is to mate with the button stem of the valve.

irst used by the French underground luring World War II. They needed valves for their radio equipment and ad to make their own. However, gas or their Bunsen burners was difficult o get and they were forced to try optical olishing and mating to seal the parts f their valve envelopes.

The process Tung-Sol has been working with was developed and is now used y the Compagnie Generale de Tele-raphie sans Fil (C.S.F.) of France. It s called polyoptic sealing. Briefly, the ew technique calls for preparing the nating surfaces of the valve envelope and stem mount by optical polishing so the valve can be evacuated before the seal is made. This requires a polishing accuracy of a few millionths of an inch.

One step in the polishing process is shown in the first photo. Here the bulb is being given the precise contour it needs so it will mate with the polished button stem of the valve. It is done by applying the bulb to a rotating abrasive sphere coated with polishing rouge. This step is preceded by several grinding and lapping operations. The button stem is subjected to a series of similar steps.

INSPECTION

After both bulb and stem have been polished they are checked under a monochromatic helium light to determine the exactness of the fit between the mating surfaces of the bulb and stem. If inspection reveals unacceptable parts, they are returned for regrinding and polishing. The inspection process consists of placing the surface to be checked against a standard and placing the pair under the helium light (see photo). Fringe patterns which reveal any defects appear as pink stripes (the colour of helium light) separated by black bands (where the light waves interfere because of foreign particles between mating surfaces or surface irregularities).

After passing inspection, the two parts are joined and attached to an evacuation pump. Then the base is heat-sealed to the shell, the valve is sealed and the process completed.

LIFE-TESTED

The advantages of the process, though costly (in production, industrial valves made by this process will cost 15 per cent more than their conventional equivalents) are best demonstrated with a short set of figures: In tests conducted for the Signal Corps two groups of type 1288 thyratrons were made—38 by the polyoptic process and 50 by standard production techniques.

Then both groups were life-tested. After 2,000 hours none of the standard-type tubes were working, but more than 55 per cent of the polyoptic-sealed

Checking a bulb and stem under a helium light to ensure that a satisfactory match has been achieved.

valves were still operating. Also, the yield of good valves is higher under the polyoptic process—85 per cent for polyoptic, only 60 per cent for conventional types.

Based on the satisfactory results of the tests, Tung-Sol is continuing its study of polyoptic sealing. The results of the study are expected to reveal whether volume production using the polyoptic technique is warranted.

MATHS IN BUILDING

THE engineering design of high multi-storey buildings subject to variable loadings may involve the use of advanced mathematical techniques. Much laborious arithmetical computation is necessary to determine the size of beams and columns used in the framework of these buildings.

Following suggestions made by Dr F. A. Blakey, of the C.S.I.R.O. Division of Building Research, Highett, Victoria, Mr F. D. Beresford and Mr J. J. Russell have made these calculations on an electronic digital computer. They have devised programs for the computer so that accurate analyses of the largest buildings now being built may be done in a few minutes compared with several days by the usual methods.

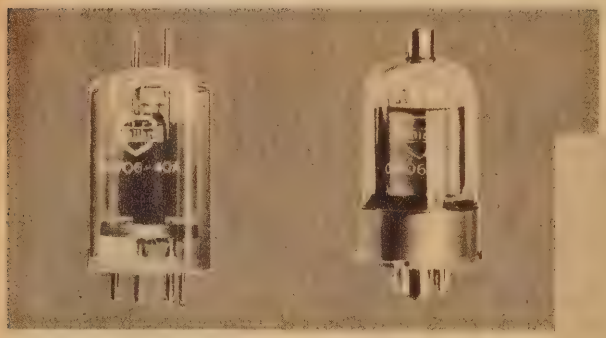
V.H.F. POWER TETRODES

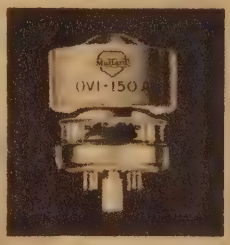
FOR F.M. AND TELEVISION TRANSMITTERS

Transmitter designers are now offered a complete range of V.H.F. tetrodes by Mullard.

These high efficiency, high gain tetrodes make possible the design of transmitters with fewer valves and, consequently, reduced initial cost.

The higher overall efficiency of equipment fitted with Mullard tetrodes results in lower running expenses — a factor in the growing popularity of these valves in the world market. Further details of these tetrodes and other Mullard valves and tubes may be readily obtained from the address below.





PRINCIPAL CHARACTERISTICS

MULLARD TYPE No.	AMERICAN TYPE No.	CV TYPE No.	DESCRIPTION	BASE	HEATER (V)	HEATER (A)	Va max. (V)	pa max. (W)	TYPICAL LOAD POWERS AND FREQUENCIES (W)	TYPICAL LOAD POWERS AND FREQUENCIES (Mc/s)
QV06-20	6146	CV3523	V.H.F. Power Tetrode	Octal	6·3	1·25	600	20	52 25	60 175
QV1-150A	4X-150A	CV2519	V.H.F. Power Tetrode	B8F	6·0	2·6	1250	150	195 140	165 500
QQV03-20A	6252	CV2799	V.H.F. Power Double Tetrode	B7A	6·3 12·6	1·3 0·65	600	2 x 10	48 20	200 600
QQV06-40A	5894A	CV2797	V.H.F. Power Double Tetrode	B7A	6·3 12·6	1·8 0·9	600	2 x 20	90 60	200 475
QY3-125	4-125A	CV2130	V.H.F. Power Tetrode	B5F	5·0	6·5	3000	125	375	120
QY4-250	4-250A	CV2131	V.H.F. Power Tetrode	B5F	5·0	14·0	4000	250	1000	75
QY4-500A	4X-500A	—	V.H.F. Power Tetrode	—	5·0	13·5	4000	500	900	110
QY5-3000A	6076	—	V.H.F. Power Tetrode	Special 4-pin	6·3	32·5	5000	3000	4100 2600	75 220

Mullard

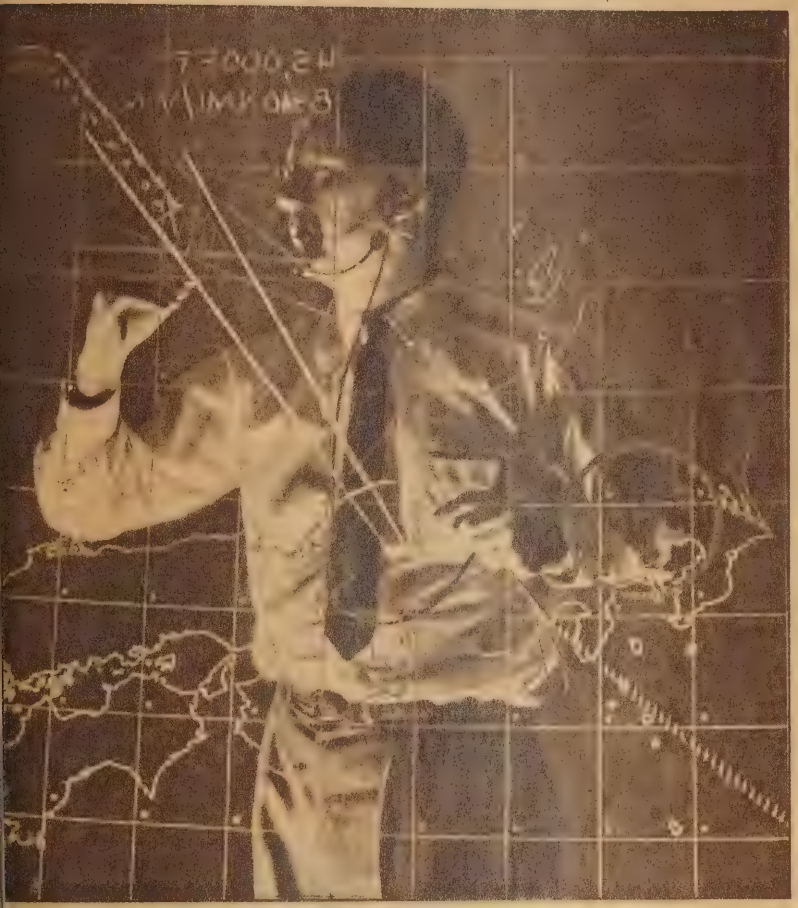
Mullard

MULLARD AUSTRALIA PTY. LTD., 35-43 CLARENCE STREET, SYDNEY, BX2006 AND 123-129 VICTORIA PARADE, COLLINGWOOD, N.5, VICTORIA, 41-6644

ASSOCIATED WITH MULLARD LIMITED LONDON, MULLARD EQUIPMENT LIMITED AND MULLARD OVERSEAS LIMITED.

MT96

REVIEW—MEN, NOT MACHINES, RUN RADAR WATCH



This device simulates approaching enemy aircraft and radar data, for operator training when no actual air manoeuvres are taking place. Data is transmitted to Mantrac board.

Reversing the normal trend, Boeing engineers are trying to replace machines with men. Their aim? To develop and refine a simple but reliable radar warning and interception system for smaller budget countries.

FAR off the Washington coast a B-52 heavy bomber begins a run on the coastline, simulating an attacking enemy using electronic counter-measures.

At Neah Bay, near the north-west tip of the State, the inbound B-52 is picked up on the scope of a search radar. In rapid sequence similar data appear on screens at radar sites near other north-west communities.

In a small room in a Boeing Airplane Company building in Seattle a group of men, faces partially masked with telephone headsets, are clustered around a large transparent plexiglas board bearing an outline map of the State cross-hatched with lines and lettering.

In this age of complex weaponry these men are testing a system of air defence control which, paradoxically, finds men replacing machines.

They watch as the sweep second hand of a wall clock climbs toward the top. Then four of the men speak into their phones, each connected to one of the warning radar sites, and request, "Data, please."

From the other end comes information on the B-52's compass bearing.

The men take protractors and straight edges and draw grease-pencil lines on their respective sides of two transparent plastic panels. These panels are mounted on each side of the map in parallel track hangers.

With one motion the men slide the panels behind the map, so that the three transparent surfaces are one behind another. Where the four compass-bearing lines intersect, a member of the team marks an "X" noting the time.

The side panels are wiped clean and the process is repeated at precise one-minute intervals until the track of the speeding B-52 is shown as a line of X marks on the map.

The local Air Defence Command battle commander in charge of this sector is kept apprised of the location and course of the moving target. At the proper time he orders an interceptor jet plane into the air. A few minutes later the interception has been accomplished.

The men remove their headsets and study the pattern of coloured markings that now adorn the board. For them it means another successful test of "Mantrac."

Mantrac, for manual angle tracking capability, is a device developed by the Boeing Aero-Space Division preliminary design defence analysis group whereby a few men with only basic plotting tools can track attacking aircraft or missiles.

Ingenious in its simplicity, Mantrac utilises an age-old mathematical principle — that of triangulation.

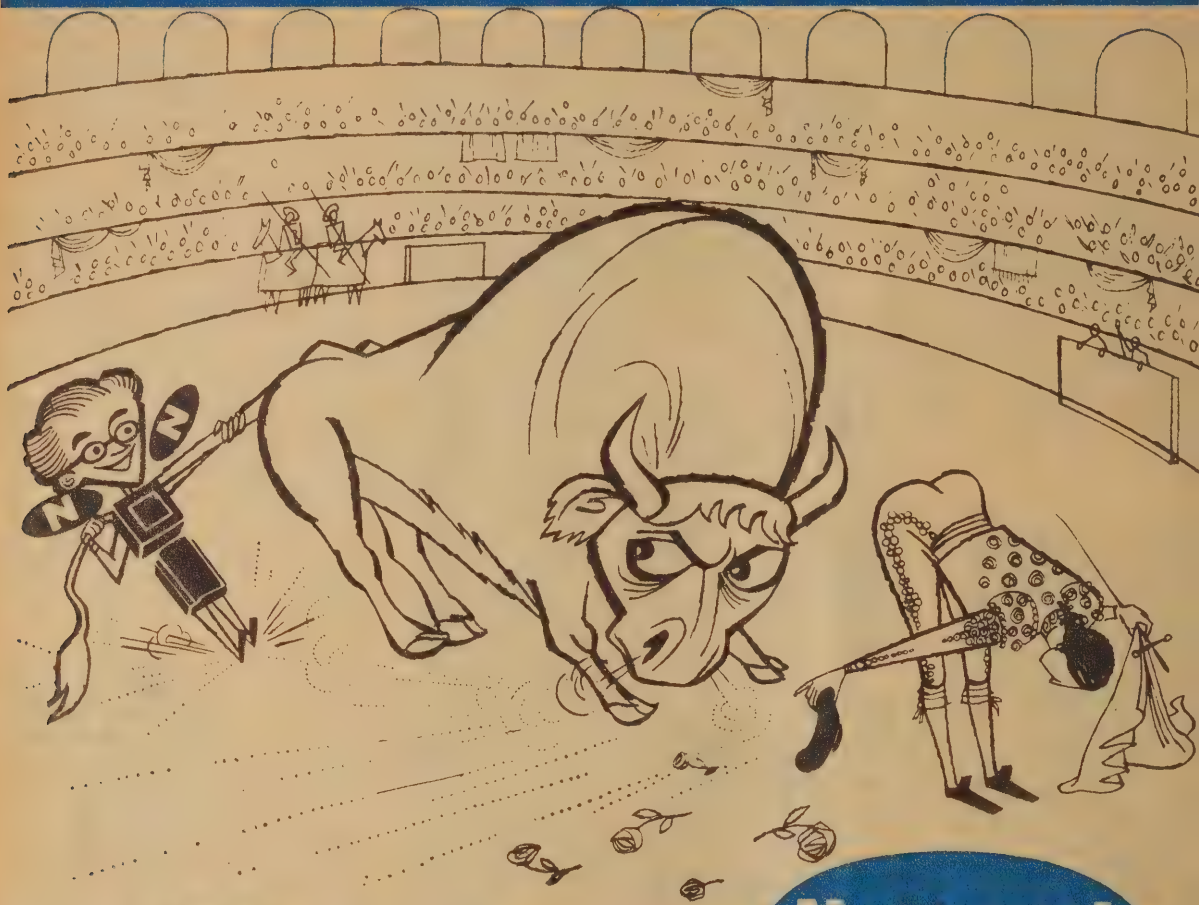
This is a method of determining the position of an unknown point by measurement of the geometric angles between the unknown and two known points a given distance apart. In this case the target is the unknown point and the radar sites the known points.

The plotters set their protractors on the centres of their boards and draw lines out along the compass headings supplied by one or more of the radar sites as they pick up the target.

In front of the main board an interpreter marks the point of intersection and accompanying data.

Plotters at corners of Mantrac board mark radar bearings, while other team members track and intercept data of simulated attack.

Service is a National habit!

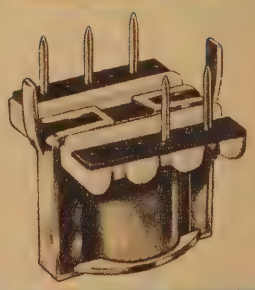


NEWS FROM National

★ NEW MINIATURE PRINTED CIRCUIT TRANSISTOR TRANSFORMER

This new NATIONAL transistor transformer is planned to save time and money. Tab mounting ensures quick, rigid mounting on printed circuit board. Positive insertion of transformer into board is guaranteed, hard brass pins cannot bend. Excellent solder ability, all pins completely tinned after transformer assembly. Longer life as vacuum wax impregnation protects from moisture.

★ *The smallest transformer manufactured in Australia*



msa954a

NATIONAL TRANSFORMERS PTY. LTD.

A Subsidiary of International Resistance Holdings Ltd

42-46 BELMORE ROAD, PUNCHBOWL — LF9378

Victoria: AUSTRALASIAN ENGINEERING EQUIPMENT CO. PTY. LTD., 202 BELL ST., PRESTON

POST THIS COUPON TODAY!

Please forward me details on National Power Transformers, Filter Chokes, Stepdown Transformers, TV Transformers.

NAME.....

ADDRESS.....

FACTORY REPRESENTATIVES:

Queensland: K. H. Dore & Sons, Brisbane. B 0268.

South Australia: B. L. Andrew & Co. Ltd., Adelaide. W 1827.

Western Australia: I. W. Holman, Perth. BA 8190.

REVIEW—EUROPE TO INTEGRATE AIR CONTROL

Three firms are bidding on a supranational system to consolidate Western Europe's regional centres. The speed with which jet aircraft cross one national area and enter another is pushing ahead plans for such a supranational automatic air traffic control system (SATCO).

EVERY day regional control centres in Western Europe have to cope with some 2,000 military and 400 civil flights.

Currently, Europe's air traffic control operates from 14 flight information centres. Britain, Germany, France, and Sweden all have three centres each within their borders. Holland and Denmark each has one.

Although well-spaced geographically, modern jet speeds make efficient manual information changeover from one centre to another tricky.

"EUROCONTROL"

The integrated control system—called "Eurocontrol" — proposes operation on an area basis so that flights are not limited to predetermined air lanes.

To date, Eurocontrol committees have settled most of the legal aspects of an integrated system. The remaining problems are technical: how many centres should be installed? And where?

Four separate technical subcommittees are now hard at work evaluating equipment and estimating costs for different ATC centre configurations.

Three manufacturers have come up with systems proposals: IBM France, General Precision Systems and Hollandsche Signaalapparatens.

While Eurocontrol is still up in the air, individual countries are making down-to-earth examinations of their own ATC systems. They are investigating automatic techniques for easing the controllers' load so controllers can be ready for the expected increase in data from Eurocontrol centres.

Furthest along is Holland, ready with a production automatic traffic control system suitable for either airlane or area operation.

Manufactured by N. V. Hollandsche Signaalapparatens, a subsidiary of Dutch Philips, the SATCO system's Phase I with automatic flight strip printing will go into operation at Amsterdam's Schiphol airport shortly. Heart of Phase I is a small, fully-transistorised two-cubicle computer using standard teleprinter code input and outputs.

PHASE TWO

Phase II, with fully automatic displays, conflict prediction, flight path calculation and automatic co-ordination between controllers, is ordered for delivery by October, 1961.

The Schiphol installation includes a radar link-up extending control outside the normal prescribed air corridors. A pi tube next to the controller carries the raw radar picture.

For position monitoring, the computer will sequentially feed predicted positions and identification symbols of each aircraft into the tube.

France, England and Germany are starting their investigations. In France,

A view inside the control tower at London airport. Experimental work already is under way here and in other parts of Europe to integrate the control of aircraft by means of computers.

IBM has completed practical experiments with RAMAC 650 and 704 computers and electric typewriter outputs to give flight strip information, conflict prediction and synthesis of plane situations.

The approach of IBM differs from that of SATCO in that most of the information remains in the computer store as flight strips are only printed out 30 minutes ahead of actual time.

Discussions are under way between IBM and the German authorities for an experimental system at Frankfurt. This, although based on the IBM system approach, may use Siemens or Telefunken computers.

In Britain, two experiments are due to start under the Ministry of Aviation. The first will set up an experimental automatic control system at London airport similar to the Schiphol installation.

Cost figures for this vary, but are estimated at about one million dollars for a complete three-sector complex. Twelve firms are currently bidding on this project.

Second experiment will be an ATC centre near the Prestwick, Scotland, North Atlantic terminal. Here early in 1961 an experimental ATC computer will calculate oceanic separations on the Transatlantic routes.

This transistorised computer, developed by Ferranti, Ltd., is designated Apollo and will parallel the normal controllers' operations. It receives its data on aircraft flight plans from the local controllers as tape inputs.

From stored programs the computer executes a conflict search and prints out flight strips for arrival times at each meridian across the Atlantic.

Result of the experiment will show whether automatic ATC methods can reduce the present separation standards on the Transatlantic run from their existing two degrees of latitude, 2,000ft. altitude and 30 minutes longitudinal flying time. (From "Electronics" April, 1960.)

AUTOMATIC WINDOW CONTROL

A FULLY automatic self-powered window control, originally designed to help people growing plants under glass, was one of the British devices described by Allan Murray in a recent edition of the B.B.C.'s General Overseas Service program "New Ideas."

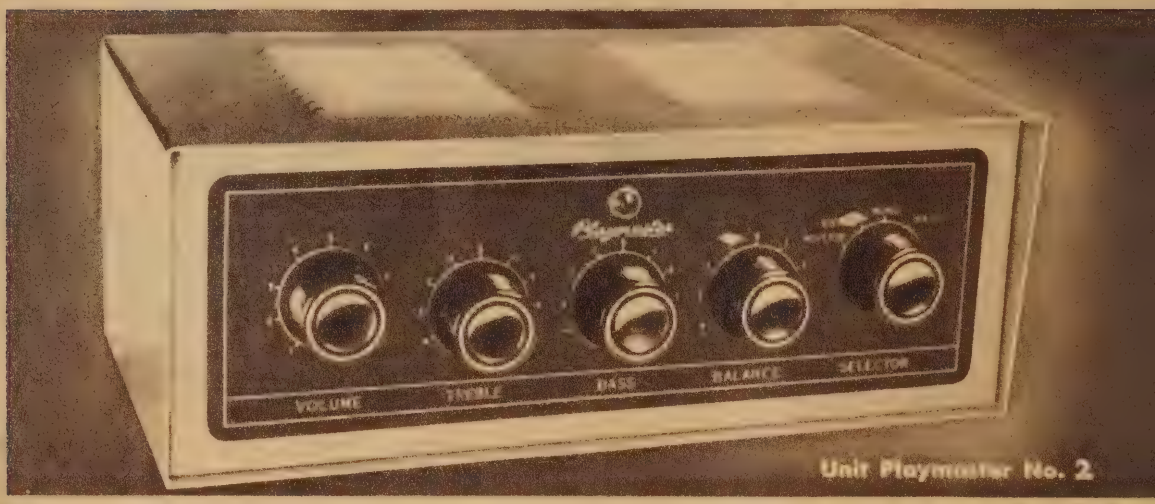
"The thermofor, as it is called, opens greenhouse windows when the inside temperature rises and closes them against cold winds," said Murray, "and is quite small, cheap and simple. It's a sealed cylinder, filled with a special fluid, and there's a piston rod in it. You fix it to any window frame that's hinged. The fluid is extremely sensitive to heat and cold. It reacts to the slightest change in temperature by expanding or contracting. This moves the piston rod, and so controls the window. It's entirely automatic, and works all round the clock with no supervision.

"And there are no running costs. The original prototype models have been in constant use now for upwards of seven years. To this day, I'm told, they've never had to be serviced or repaired. But recently their fame has spread—in cold climates and warm. Farmers and nurserymen in Europe, from the Baltic to the Mediterranean, in the United States and as far afield as Australia, are beginning to discover for themselves the merits of something which makes the weather work for them, and free of charge."

UNIT PLAYMASTER No. 2

14-watt Stereo Amplifier

(AT LEAST EIGHT WATTS MAX. PER CHANNEL)



AT A PRICE ALL CAN AFFORD

Complete kit of parts, **£39/14/-** Wired and Tested, **£49/18/-**

Designed by "R.T.V. & H.," Playmaster brings you true hi-fidelity at far less cost than similar imported equipment. We also quote and supply from a wide range of high-quality speakers and players to suit any Playmaster combination.

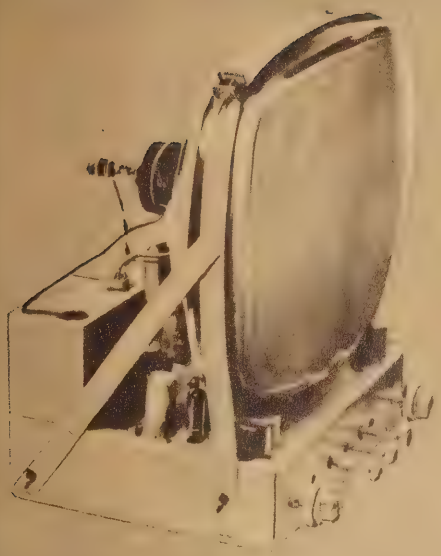
THERE'S A PLAYMASTER FOR EVERY PURPOSE

SPECIFICATIONS
Performance figures and circuitry used is detailed in "R.T.V. & H.," August, 1960. We supply best-quality components to "R.T.V. & H." specifications in all kits and completely built units.

Originally designed by "R.T.V. & H.," the Playmaster range includes:—
17-watt stereo or mono, 10-watt stereo or mono, 5½-watt stereo, 13-watt mono, plus a complete range of tuners embracing A.M., F.M. and dual wave.
Send coupon or write now for full details of Playmaster hi-fi equipment.

POWER OUTPUT: A full seven watts per channel, rising to a maximum of eight watts per channel.
VALVES: Four—6BM8 in twin U L output. One—12AU7 twin voltage amplifier.
RECTIFIERS: Two contact-cooled, selenium-type IN1763 rectifiers.
OUTPUT IMPEDANCE: 15 ohms. Others as required.
SWITCHING FACILITIES: (a) Stereo; (b) stereo (reverse); (c) mono; (d) radio tuner; (e) spare.
TONE-CONTROL RANGE: Treble cut and boost, 12 dB.; bass cut and boost, 12 dB.
BALANCE-CONTROL RANGE: Equal both channels; to cut-off either channel.
INDICATOR BEZEL shows unit in operation.
FINISH: Modern metal case — Seamless welded, baked enamel, beige hammertone, self contained.
Attractive label — Coffee brown, gold lettering.
Beautiful imported knobs—Brown or ivory, gold centres.
FITTING: Self-contained case (as above). Also available less case for panel mounting.

ELECTRONIC PARTS PTY. LTD.



Outstanding results are reported from **all** States. Since first released, N.S.W. and Victoria have consistently recorded good results even in some locations upwards of 300 miles from the capital cities. Now, equally good reports are coming from clients in Tasmania, West Australia, Queensland and South Australia.

BUILD YOUR OWN TV RECEIVER

3", 21" and 17" MODELS

"R.T.V. & H." 110° DESIGN

The kit is complete in every detail. Ready-drilled chassis, all valves, A.W.A. picture tube and deflection components, Q + IF strip and latest Philips tuner ready wired and matched together. Beautiful imported gold centre knobs, etc., etc. LOW COST—amazingly low for a really first-grade receiver.

CABINET KITS

High-quality timber packs, complete with trim and building instructions, are available.

.S. & A. BANK BUILDING
06 BROADWAY, N.S.W.
pp. GRACE BROS.)
HONES: BA 4891, BA 4892-3

To "BROADWAY ELECTRONICS" Section

ELECTRONIC PARTS PTY. LTD.

Dear Sirs,

Please send me full details of the following (mark square for information required).

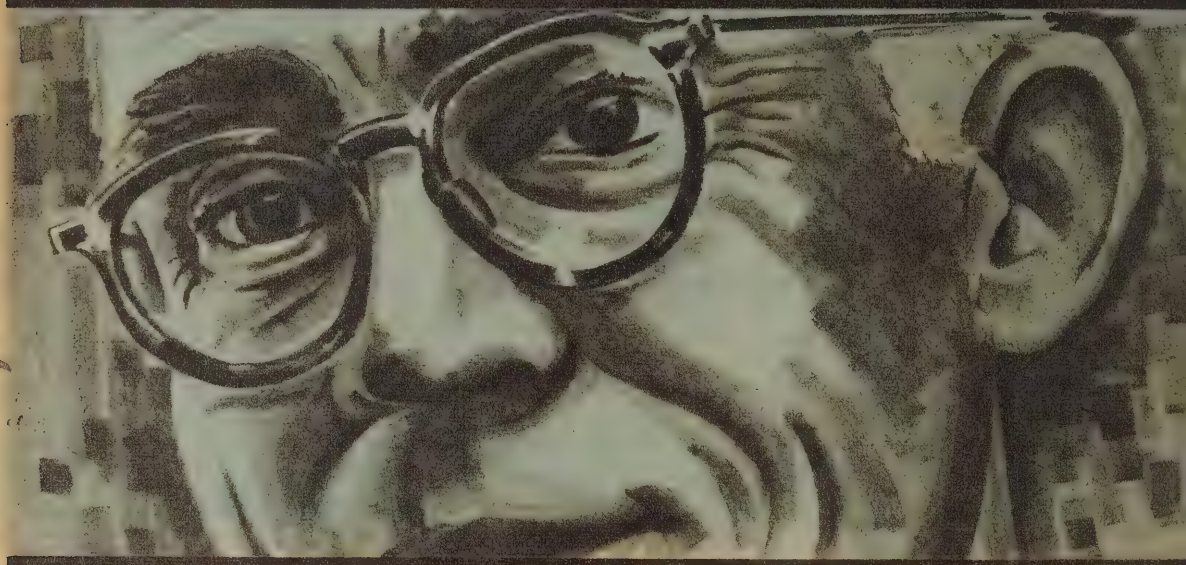
☐ Playmaster Hi-Fi

☐ 110 TV Kit

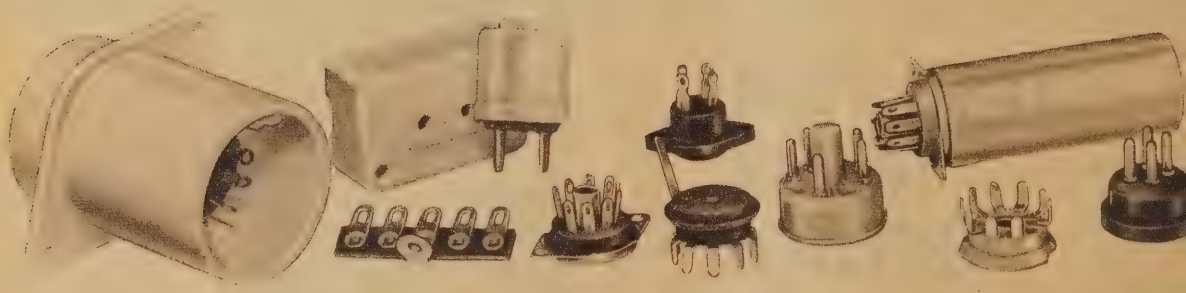
Name

Address

CONFIDENCE!



TELETRON



Eliminates Compromise

Teletron introduced a new concept in the field of electronics in Australia when they combined high standards of reliability and accuracy with economic pricing. Proven design, local production, automatic inspection, real service; these are the reasons electronics manufacturers have confidence in Teletron.

TELETRON
COMPONENTS

MSA998

AUSTRALIAN & OVERSEAS AGENTS:

Wm. J. McLellan & Co. Pty. Ltd.

126 SUSSEX STREET, SYDNEY—BX 1131

VICTORIA, AUSTRALASIAN ENGINEERING EQUIPMENT CO. PTY. LTD., 202 BELL STREET, PRESTON

SCIENTIFIC & INDUSTRIAL NEWS

Non-inflammable plastic

A NEW thermoplastic has exceptionally high resistance to both heat and chemical attack as well as good electrical properties and low moisture absorption.

The new material is also highly transparent and film made from it is said to be virtually impermeable to moisture vapour and to many common gases. At the same time, the plastic has good physical properties.

The compound, which is based on chlorotrifluoroethylene, is said to retain its properties over a wide range of temperatures running from those encountered with liquid air (about minus 190 degrees Centigrade) to about plus 200 degrees Centigrade.

The new plastic, which is expected to be available in Europe in 1961, can be fabricated by means of a variety of techniques, including injection, extrusion and other moulding processes.

The material is expected to find applications in many different industries, ranging from mechanical engineering to electrical and chemical engineering.

Allied Chemical Corporation, 40 Rector Street, New York 6, N.Y., U.S.A.

New varnish for electronic components

A NEW varnish with a low curing temperature, and able to withstand continuous operating at high temperatures of the order of 400 degrees Fahrenheit, has been developed for protecting electronic components.

The new compound has excellent electrical properties giving protection against leakage caused by contaminants and also breakdowns at high altitudes. It also reduces the absorption of moisture and has satisfactory fungicidal properties.

The compound can be applied by dipping, brushing, spraying or vacuum impregnating, and since it is transparent this can be done without obliterating the markings on the components concerned.

The compound is based on the use of a silicone material and is said to combine water-like thinness with extremely good adhesion even under very stringent operating conditions.

Melpar Inc., 3000 Arlington Boulevard, Falls Church, Virginia, U.S.A.

Fuel system filters

DESIGN engineers faced with difficult problems connected with the filtration of fuels, hydraulic fluids, lubricating oils and caustic solutions are being offered new filter media.

The filters are generally made from stainless steel, but they can also be made, if required, from almost any metal that can be drawn in fine wire forms.

They are manufactured with inserts in the form of seamless porous tubes, flat sheets, pleated discs and cylinders and in many other forms. They can be welded, silver soldered or cemented.

The method of construction makes them very suitable for use where there is likelihood of sudden pressure surges and conditions of severe vibration.

They can be designed to withstand pressures of over 3,500lb per square inch and to operate in temperatures ranging from minus 350 degrees Fahrenheit to plus 500 degrees Fahrenheit or more.

Vokes, Henley Park, Guildford, Surrey, England.

Cement for insulation

A NEW cement, for thermal insulation purposes, can be cast and is exceptionally quick in setting.

The cement is non-corrosive and non-rusting to metals and other similar materials. At the same time, it can be premoulded to create fittings of pre-determined sizes and shapes which will not shrink on hardening.

Indeed, the material can be poured to any thickness without shrinking and it can be applied simply by means of spraying, injecting, trowelling, packing by hand or "palming."

Thermold Products Company, Grandview, Missouri, U.S.A.

Oscilloscope tube

INFORMATION can be stored for almost indefinite periods and later used to give a display as required for the information by means of a new direct-viewing storage oscilloscope tube.

The tube has two electron "guns" the first of which "writes" information in the form of electric signals on a storage layer or mesh. The second gun enables the stored sign to be displayed at will on the phosphor screen.

With the tube the display can be retained as long as required, and successive wave-forms can be stored and displayed together for comparison. The tube, which will be available by the end of this year, is expected to be used chiefly in special oscilloscopes for displaying transient wave-forms.

Mullard, Mullard House, Torrington Place, London, W.C.1, England.

Treads with strong grips

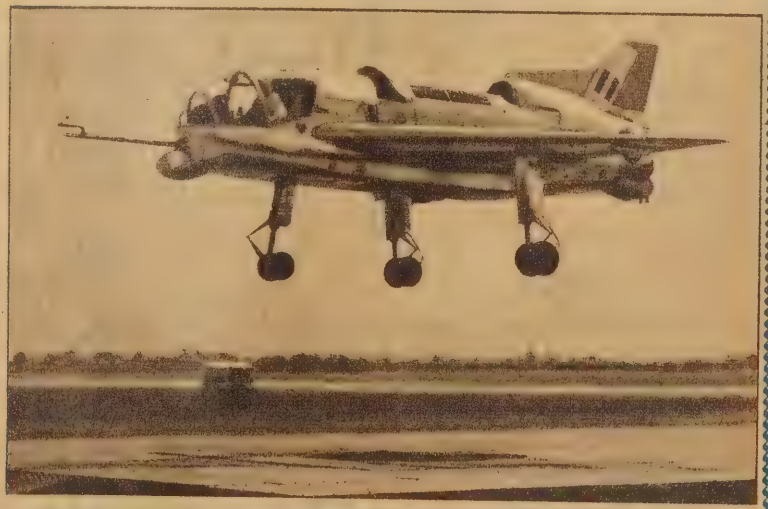
A NEW type of metal track for a wheeled vehicle is considerably more efficient in operation on soft ground than spiked or spudded wheels owing to its treading action.

Two advantages of the new type of plate wheel are that it automatically adjusts itself to changing ground conditions whether the surface be smooth or bumpy, while eliminating the need for a pneumatic tyre.

The wheel is also simple to construct and possesses no complex parts to break down, since it does not employ sliding bearings, or gearings. On the other hand, it does make extensive use of rubber to metal bonded construction and, therefore, possesses exceptional elasticity, giving a smoother ride than could otherwise be obtained without the use of a pneumatic tyre.

National Research Development Corporation, 1 Tilney Street, London, W.1, England.

BRITISH VTO RESEARCH PLANE



At first glance one might mistake this for just another picture of a conventional aircraft coming in to land. Instead it's taking off—and straight up! It is a Short S.C.1, research unit designed for vertical take-off and landing. It has five jet engines, four mounted vertically in a central engine bay and the fifth horizontally in the tail. After vertical take-off the four engines are inclined backwards to assist the horizontal engine to provide forward thrust.

GENERAL ACCESSORIES

PTY. LTD.

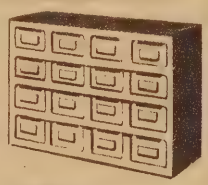
100 Clarence Street, Sydney

Phone BX4451

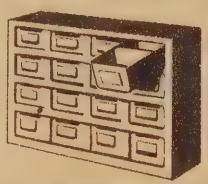
HANDY CABINETS

A craftsman built unit attractively painted in pearly grey baked enamel with provision for fitting identification card on each drawer. A strong and most useful cabinet for holding small parts or tools, ideal for mechanic, engineer, garage, store-keeper or home workshop. Provision is made for stacking and all units will interstack.

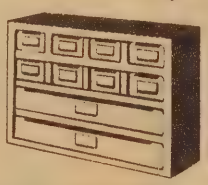
Available in the following Models Packed in a Strong Carton.



MODEL A
52/-
Cabinet 12" x 9" x 5¼". 16 drawers 5¼" x 2⅝" x 1¼".



MODEL H
55/-
As Model A—but fitted with Divisions.

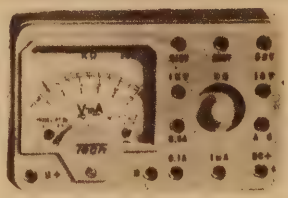


MODEL D
52/-
Cabinet 12" x 9" x 5¼" 8 drawers 5¼" x 2⅝" x 1¼". 2 drawers 11" x 5¼" x 1¼".

SCOPE

SOLDERING IRONS 6 sec.

Standard	£2/15/-
Instrument	£2/15/-
Vibroscope	£1/15/-
Transformers	£2/15/-



Supplied complete with test leads.

BRAND NEW MULTIMETERS 49/6

Plus postage.

Meter 0-1MA 1000 OHMS PER VOLT

A.C. RANGES	D.C. RANGES	CURRENT RANGES
0—10V	0—10V	0—1MA
0—50V	0—50V	0—100MA
0—250V	0—250V	0—500MA
0—500V	0—500V	
0—1000V	0—1000V	

OHMS RANGE—0-100,000 OHMS

CRYSTAL SET BUILDERS

Single Gang Condensers,	1 guinea
Q Plus Headphones	£2/1/
Spring Terminals	1/2 ea.
Germanium Diodes	
OA70—OA73	6/1 ea.
OA81—OA85	7/1 ea.
Jabel Crystal Coil	8/6 ea.
Aerial Wire (100ft)	14/9 ea.
Insulators	1/ ea.
Boys' Book of Crystal sets	5/ ea.
Single Crystal Earpiece, complete with lead and plug	18/6

MANUALS

Radio Servicing No. 1	7/6
Radio Servicing No. 2	8/9
Radio Servicing No. 3	7/6
Fault Finding	7/6
Magnetic Recording Wire and Tape	7/6
Transistor and Crystal Diodes	7/6
The Oscilloscope Book	8/
Television Servicing No. 1	8/
Television Servicing No. 2	8/
Television Servicing No. 3	8/
Television Servicing No. 4	11/-
Using an Oscilloscope	9/6
Servicing Transistor Receivers	9/6

PHILIPS VALVE DATA BOOK NEW ISSUE 18/6, plus 2/1 postage.

GLEN RADIO AC/DC INVERTERS

50 watt inverters:
12, 24, 32, 50, 110, 230v DC input
230v 50 cycles AC output—
£22/9/6

100 watt inverters:
12, 24, 32, 50, 110, 230v DC input
230v 50 cycles. AC output—
£33/2/6

150 watt inverters:
12, 24, 32, 50, 110, 230v DC input
230v 50 cycles, AC output—
£37/1/3

RECORD CHANGER AND PLAYER SPECIALS

4 SPEED PLAYER	£8 0 0
4 SPEED CONQUEST CHANGER	£10 15 0
4 SPEED 6 VOLT BATTERY OPERATED PLAYER	£13 12 6
4 SPEED STEREO PLAYER	£12 12 6
4 SPEED STEREO CHANGER	£17 10 0
4 SPEED TRANSCRIPTION UNITS less pickup	£20 0 0
4 SPEED TRANSCRIPTION UNITS with Arm	£26 15 0

ALL BRAND NEW IN UNOPENED CARTONS

Fully Guaranteed
BE EARLY

Screw-type hole cutters

⅝" 7 pin	£1/9/-
⅝" 9 pin	£1/15/-
1¼" Octal	£2/18/-

CRYSTAL SETS: Q-Plus set only **£2/13/6**
Q-Plus; complete with aerial, headphones, etc **£4/19/6**
Q-Plus Transistor model, complete with aerial, headphones, etc. **£6/19/6**

GENERAL ACCESSORIES PTY. LTD.

100 CLARENCE STREET, SYDNEY. PHONE BX4451
and 30 Buckland Street, Chippendale. Phone MX4701

New antibiotics

A NEW antibiotic drug which is said during experimental tests to have shown itself to be a potentially important new weapon against a wide range of infections, including skin diseases, bacillary dysentery, acute pneumonia and malignant fever, has been developed.

The new compound belongs to the so-called tetracycline group, but possesses the advantage as compared with other antibiotics that it can be used effectively with only half the dose, and at the same time is capable of staying in the human system for twice the length of time.

Further tests and experimental work on the new antibotic is being continued and it is expected that it will be made commercially available in the relatively near future.

Lederle Laboratories (U.S.A.), Bush House, Aldwych, London, W.C.2., England.

Rot-proof cotton

A NEW chemical process makes cotton fabrics more resistant to rotting and attack by mildew.

The treatment can be applied to all kinds of cotton fabrics. In one test, treated cotton retained 100 per cent of its breaking strength after 21 weeks of exposure in tests using soils containing fabric-destroying bacteria.

Other tests have shown that the process can be used in conjunction with some fabric-colouring pigments to improve the resistance of cotton to deterioration as the result of exposure to sunlight.

The treatment depends upon the use of a colloid of methylolmelamine. This compound forms resin which penetrates the outer portion of the cotton fibre cell wall to become part of the fibre, thus making the treatment far more effective than that which could be achieved by means of a conventional protective coating.

New silicone rubbers

SILICONE rubbers which can be cured at room temperature and thus be used where ordinary silicones (needing high curing temperatures) cannot be employed have been developed.

They are claimed to be excellent materials for sealing, patching and potting where extremes of temperature are ultimately expected. They are also said to be suitable for moulding silicone rubber parts when heat curing is undesirable or when the cost of conventional rubber moulding is not justified.

The cure times of the rubbers can be varied by altering the concentration of the curing agents. Two of these are available — one is a general purpose product and other a slow curing type.

The curing is an irreversible process and the resultant rubbers are completely stable products with all the advantages of conventional silicone rubbers.

Imperial Chemical Industries, Nobel Division, Silicones Department, Stevenston, Ayrshire, Scotland.

Protecting ferrous metals

A NEW protective coating can be applied to ferrous metals and their alloys, and is exceptionally resistant to corrosion even at very high temperatures.

The coating can retain its toughness at temperatures of up to 900 degrees Centigrade. The compound is also said to have good adhesion to the base metal to which it is applied and to provide exceptional protection against corrosion and other similar forms of destructive attack.

The new coating is particularly effective when applied to ferrous metal alloys containing chromium. It is made by applying a zirconium-rich alloy, powdered zirconium, or zirconium hydride mixed with an evaporable organic liquid binding material to the cleaned metal surface.

During the process of application the metal must be heated to a temperature of at least 900 degrees Centigrade either under vacuum conditions, or in an inert or chemically non-reactive atmosphere.

During the application process the zirconium diffuses into the metal and the coated metal must be allowed to cool under the same vacuum, or inert atmospheric conditions, under which it was applied.

British patent No. 820614.

Dry ice in civil engineering

AMERICAN civil engineers recently found a novel use for dry ice—carbon dioxide snow. In a theatre reconstruction job in Chicago, they wanted to replace some columns while they were still bearing a load.

New columns, a few thousandths of an inch shorter, were put into place beside the old ones. Then the old ones were packed in dry ice, which cooled and contracted them. As they shrunk, the load of the whole building was lowered on to the new uprights. Still cold and short, the old ones were removed.

Soldering iron

A NEW soldering iron does not require external heat of any kind. The heat is provided by a patented cartridge which contains a thermic mixture sealed in a steel shell.

The iron is said to be easily recharged with a new cartridge. Within seconds of being "fired," the cartridge is designed to attain a temperature of about 860 degrees Fahrenheit and maintain a steady soldering temperature for six to eight minutes.

Jenolite, 13-17 Rathbone Street, London W.1.

Wear-resistant coating

A NEW compound, which is said to have exceptional resistance to physical wear even at very high temperatures, has been developed.

The coating is based on the use of a chromium-carbide type compound. It can be applied relatively simply to a wide variety of different shapes, or parts, by means of a flame-plating technique.

The new coating, which will withstand operating conditions at temperatures of up to 1,300 degrees Fahrenheit, is expected to find applications in many different fields of mechanical engineering where excessive wear is encountered, together with high temperature operating conditions.

Linde Company, Flame Plating Sales Department, Indianapolis 24, Indiana, U.S.A.

The RADIOMASTER

RADIOGRAM CHASSIS . . .

A great performer on Radio and Records

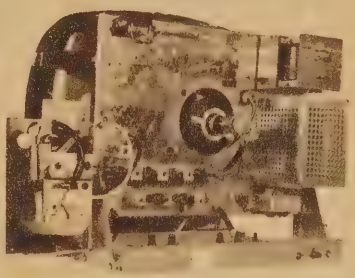
STEREO MODEL S77 gives glorious three-dimensional sound that comes from everywhere in the room. Features include dual treble, bass and volume controls, also balance control. Broadcast and short-wave radio. Seven valves. Single chassis. Two speakers.

PRICE, £38/10/-

Stereo Model S66, 6 valves £31/10/- Mullard Amplifiers and Kits also available.

Packing included. Freight extra.

TELEVISION CHASSIS



21in models from £95

RADIOGRAM — TV & STEREO CABINETS

Many popular designs are available, including combination Radio-TV-gram. All colours, first-class finish.

New models for stereo incorporate speaker enclosures or we will make your stereo furniture to order. Quotations given. TV cabinets can be supplied complete with brackets and straps for picture tube mounting.

ALL TYPES OF FOUR-SPEED & STEREO RADIOGRAM UNITS

WRITE FOR CATALOGUE.

H. B. RADIO PRODUCTS

103-105 Catherine Street
Leichhardt, SYDNEY
Telephone LM5580

The completed instrument is housed in a small standard instrument case. The range switch is visible to the left of the tuning dial, with the attenuator controls below it. The remaining control is the "OFF-CW-MOD." switch.

Compact Six Band Service Oscillator

Providing a choice of modulated or unmodulated output over all the domestic high-frequency bands, this small but efficient instrument should meet the requirements of experimenter and serviceman alike. Modern components incorporated into a well-established circuit make this design most attractive.

FOR anyone engaged in radio servicing, general experimental work, "ham" activities, etc., a modulated oscillator in some form is virtually essential. By providing a signal of known frequency and strength, modulated or unmodulated as required, it enables precise tests to be made on a wide variety of gear. While receiver alignment is the most obvious application, and the one for which most readers will require it, it will be found to have many other uses, from straight out trouble shooting to ham shack activities.

An important application if it has a usable frequency range on fundamentals up to about 70 megacycles, is a marker generator for television alignment, both in the IF and RF sections of the receiver. In an emergency, a rough IF alignment can be made with such a unit, combined with a suitable meter at the detector, if a sweep generator is not available.

There are many applications requiring the use of a more elaborate form of modulated oscillator, usually called a "signal generator." Such an instrument usually incorporates a meter for monitoring the output and checking the modulation depth, and may modulate the carrier in an amplifier stage to improve frequency stability and minimise frequency modulation effects.

An instrument of this type is usually fitted with quite elaborate shielding, and may also be fitted with a calibrated attenuator. (Without careful shielding attenuator calibrations are generally meaningless.)

Naturally, such an instrument tends to be bulky and rather costly, whether bought commercially or constructed.

The simple type of modulated oscillator, however, despite the lack of signal generator refinements, can be extremely useful in servicing and experimental applications. For many of these applications it is more than adequate, while its portability and low cost may make it actually preferable to the bulky and expensive signal generator.

USEFUL INSTRUMENT

We felt, therefore, that there was quite a need for a simple modulated oscillator of this type, particularly if designed to take advantage of modern valves and components. In particular we wished to gear it to the present market condition to ensure that anyone who wishes to build it will be able to obtain suitable components with a minimum of trouble. Accordingly, we set out to evolve a design which would satisfy these requirements.

In the May, 1947, issue of the magazine, we published a design for a modulated oscillator which used a 6SN7-GT double triode. One triode section was used as a Colpitts RF oscillator, and the other triode section was used as a Hartley AF oscillator. A centre-tapped speaker transformer was used as a tuning inductor for the Hartley circuit and as modulation choke for plate modulation of the RF oscillator.

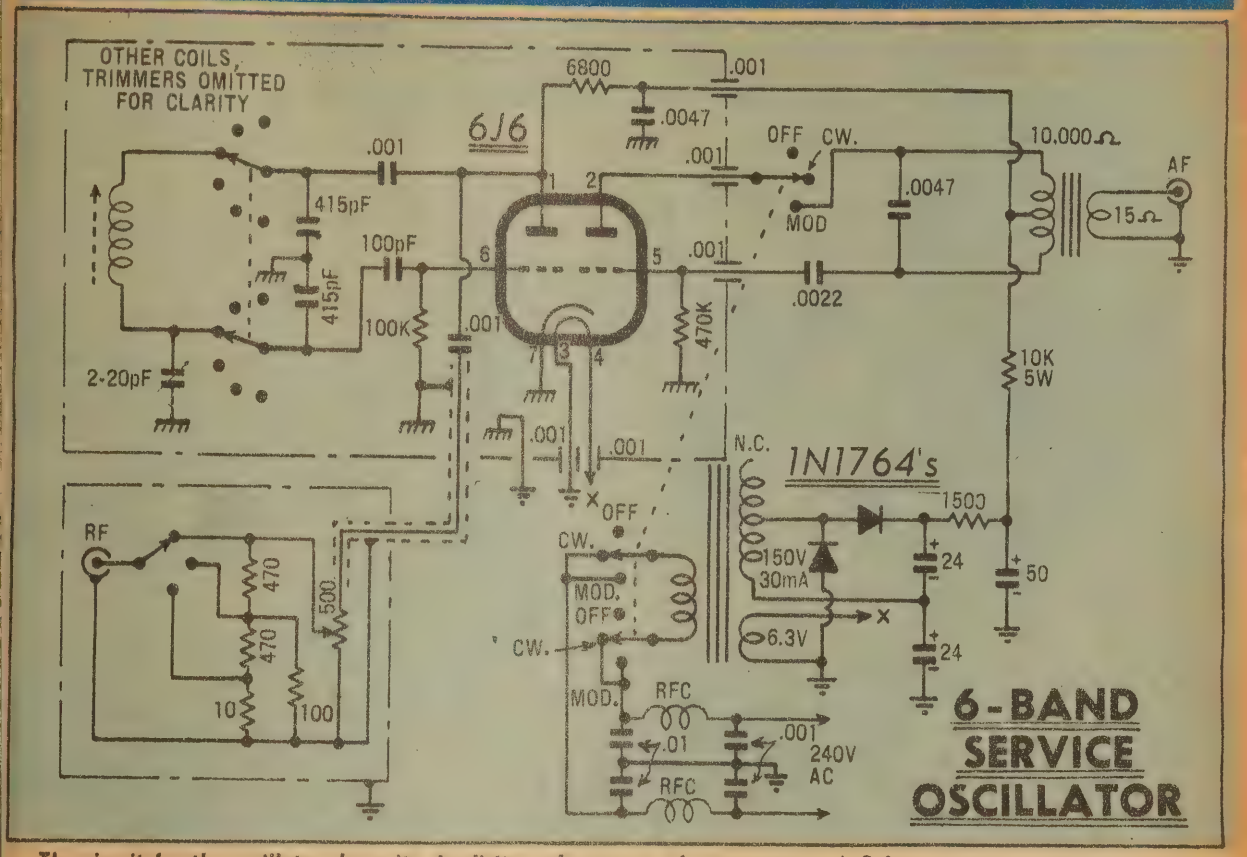
This circuit was capable of very good results despite its simplicity, and proved very popular among readers. With this in view, we investigated the possibility of utilising this basic circuit in the present design, bringing it up-to-date with modern circuitry trends, and modern components.

As can be seen from the circuit, the electrical side of the design is very similar, the main changes being in the components used. The range of parts available to the home constructor has improved considerably in recent years and we have been able to take advantage of this to good effect. To show how this has been done we will detail briefly the operation of the circuit and the physical layout of vital components.

The RF oscillator is again a Colpitts circuit, utilising one half of a 6J6 double triode. Each frequency band is provided by selecting a suitable coil with the rotary switch, and continuous tuning over each band is done by the two-gang

by Jamieson Rowe

SIMPLE CIRCUIT OPERATES INTO VHF REGION



The circuit for the oscillator shows its simplicity and economy of components. A Colpitts circuit is used for the RF oscillator and a Hartley circuit for the audio oscillator. The use of a modern miniature double triode enables the high frequency range of the unit to be extended.

variable capacitor. Each coil is provided with an iron-dust slug and trimmer to facilitate the calibration of each band to a ready-made dial.

The second half of the 6J6 is used as a Hartley audio oscillator as before, using a small centre-tapped speaker transformer. The unused secondary winding on the transformer is used as a convenient source of low impedance audio signals.

The RF and audio oscillators are fed HT through a common resistance, and thus the audio developed across the resistance modulates the RF oscillator. The presence of the resistor is also beneficial to the waveform of the audio oscillator, as it introduces negative feedback into this circuit. A much purer waveform is thus obtained.

DISCONNECTED

When modulation is not desired, the plate of the AF oscillator is disconnected, stopping the oscillations.

The power supply is a doubler circuit, using two IN1764 silicon diodes. Filtering is provided by the 1500 ohm 5 watt resistor and the 60 mfd electrolytic capacitor. Resistance-capacity filtering is quite in order here, as the current drain is low.

Two poles of the "OFF-CW-MOD" switch are used for mains switching in the primary circuit of the mains transformer. Two RF chokes and four capacitors form a Pi-section filter in the

PARTS LIST

1 Small standard Instrument Case, approx. 9in x 7in x 5½in.
1 Chassis to suit.
1 Power Transformer, 150-0-150 volts at 30mA., 6.3 volts at 1.8 amps.
1 Speaker Transformer 10,000 ohm C.T.
1 2-gang miniature variable capacitor, 10-415 pF with H law.
1 3 pole 3 position rotary switch.
1 Single pole 3 position rotary switch.
1 2 pole 6 position rotary switch with shorting out rotors on rear of sections.
1 6J6 valve.
2 IN1764 silicon diodes.
6 7/16in diameter coil formers with iron dust slugs.

RESISTORS

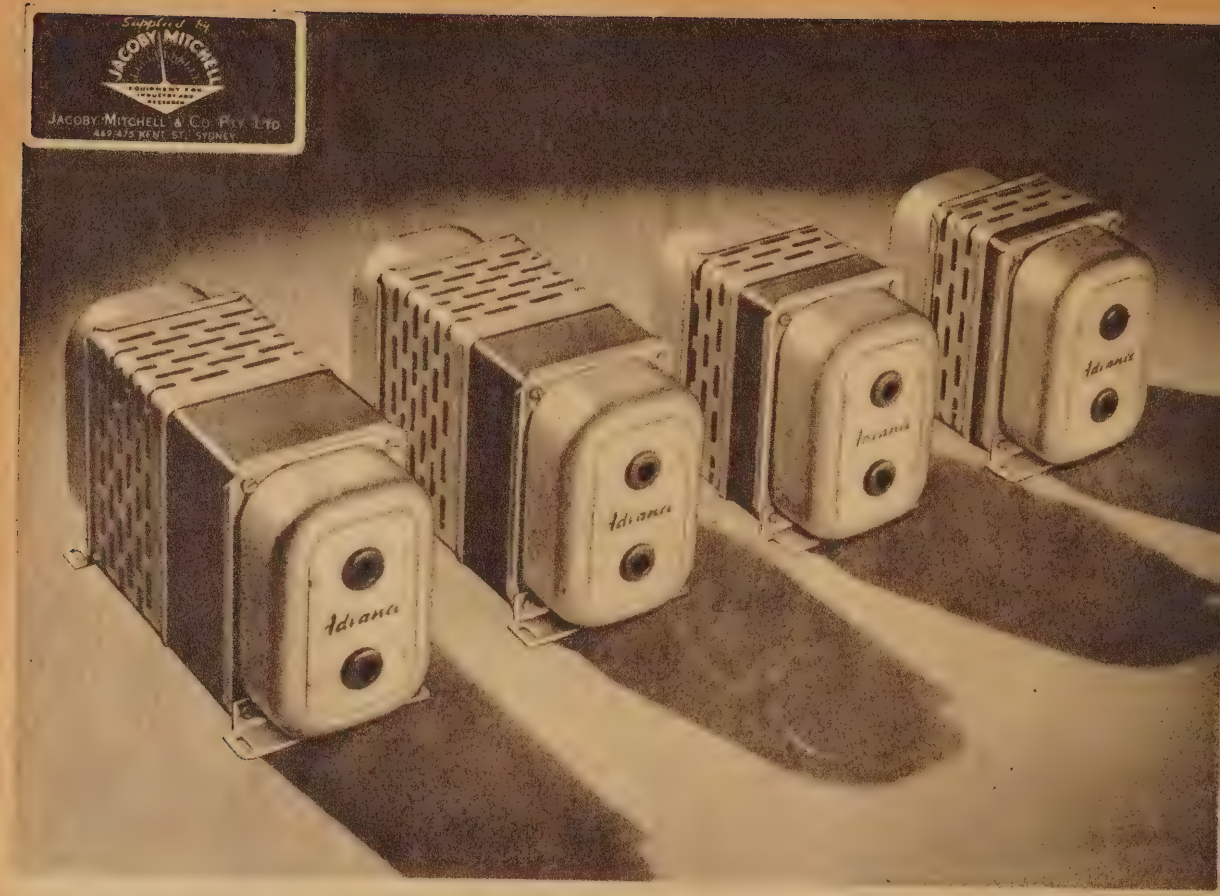
1 10K 5 watt wire wound.
1 500 ohm carbon pot with concentric shaft extending at rear.
1 1500 ohm 5 watt wire wound.
1 470K ½ watt carbon.
1 100K ½ watt carbon.
1 680Ω ½ watt carbon.
2 470 ohms ½ watt carbon.
1 100 ohms ½ watt carbon.
1 10 ohms ½ watt carbon.

CAPACITORS

6 2-20 pF. ceramic trimmers.
5 0.001 mfd. ceramic lead-through capacitors.
2 0.001 mfd. disc ceramicons.
1 100 pF. ceramicon.
2 0.01 mfd. 600 volt paper.
2 0.001 mfd. 600 volt paper.
2 24 mfd 450 volt electrolytics.
1 50 mfd 450 volt electrolytic.
1 0.0047 mfd. 600 volt paper.
1 0.01 mfd. 600 volt paper.

SUNDRIES

1 10 lug length of 1¾in terminal board.
2 Chassis mounting co-axial sockets.
2 Rigid insulated ¼in to ¼in shaft couplers.
1 Flexible ¼in to ¼in shaft coupling with 3/16in to ¼in sleeve.
Length of perspex rod (¼ inch diameter) for channel spacers.
2 3inch studs threaded 5 BA.
2 ¼in spacers for switch.
1 Dial scale.
Sheet metal for channel.
Sheet copper for attenuator shield. 2-RF chokes, ceramic valve socket and shield, length of ¼in rod for channel strengthening bars, knobs, grommets, screws, mains cord, etc.



VOLSTAT C.V SERIES

CONSTANT VOLTAGE TRANSFORMERS

Advance

MODELS FROM 8 TO 100 W.
OUTPUT VOLTAGE ± 1%.
for ± 15% primary variations.

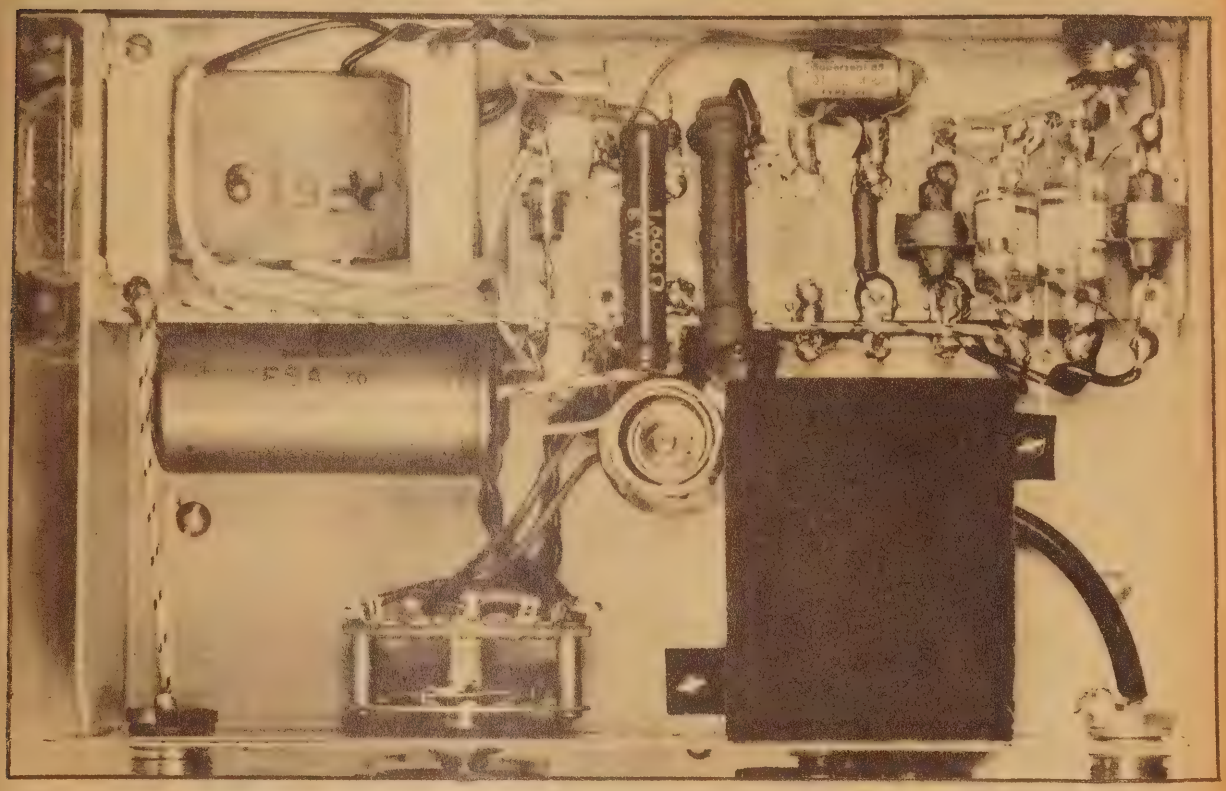
JACOBY, MITCHELL and Co. Pty. Ltd.

469-475 Kent Street, Sydney — MA 8411

Also at: 113 Bridge Road, Richmond, (Vic.) JB5100

135 Beaumont St., Hamilton, (Newcastle) MA4744

UNDERCHASSIS VIEW SHOWS COMPONENT LAYOUT



This view shows the underside of the main chassis. At the upper left is the power transformer, mounted on its side, and alongside it is the tagboard, supporting the power supply, audio and mains filter components. In the centre can be seen the valve, mounted upside down and passing through a clearance hole in the main chassis.

mains lead to reduce leakage radiation from the instrument.

The 6J6 valve is a relatively new, miniature 7-pin type, with higher gain and lower internal capacities than the older 6SN7 used in the previous instrument. This introduces the possibility of operation at a higher frequency, which we investigated and found quite practicable.

Taking advantage of this, we were able to provide a sixth band on the new instrument, extending its range to 90 Mc. This feature is quite important, as it enables it to be used as a marker generator for TV alignment. A typical combination for this job would thus be this oscillator and the simple "36 Mc Sweep Generator" of May, 1960.

OUTPUT

The RF output of the oscillator is derived from the plate via a two-stage attenuator. One of the attenuator stages is a switch, used for a coarse control, and the other is a potentiometer, used as a fine control. Shielded microphone-type co-axial connectors are used for both the RF and AF outlets.

Mechanically, the instrument is quite conventional, being built into our small standard instrument case. The complete RF oscillator circuitry is built into a U-shape channel made from brass or cadmium-plated steel, which permits easy earth connections and definite by-passing.

The shape of this RF chassis allows the coils to be arranged and supported logically and firmly around the range switch. It also means that another U-piece may be added to form a shield box easily, if one is found necessary. As the photograph shows, two spacers cut from ¼-inch brass rod are used to keep the channel rigid.

The RF chassis is raised and insulated from the main chassis by four insulating spacers ½-inch long. This reduces stray radiation, particularly if the channel is used as a shield box, by restricting all RF chassis currents. We made the spacers from ¼-inch perspex rod, drilling and tapping them to take the 3/16in Whitworth screws used in mounting the channel.

The oscillator valve socket is mounted so that the valve is upside down, hanging from the RF chassis, and extending through a large clearance hole in the main chassis. We punched an octal socket mounting hole, 1¼in. in diameter, which provides quite sufficient clearance. This procedure allows oscillator leads to be as short as possible.

SPINDLES INSULATED

The operating spindles of the tuning capacitor and the range switch are extended with insulated couplings to prevent them electrically touching the case. Suitable couplings are readily available commercially, made from plastic, but satisfactory substitutes may be made from ¼-inch perspex rod.

The RF chassis is connected to the main chassis only via the intentional earth lead, ensuring a single earth connection.

Power supply leads to the RF oscillator are introduced into the channel with lead-through capacitors, thereby by-passing them to minimise radiation and possible leakage. The leads to the plate and grid of the audio oscillator are also passed through lead-through capacitors. This is desirable because the audio circuitry is beneath the chassis, separate from the RF circuitry.

The range switch is a rotary type having a shorting-out rotor on the rear of both sections. The shorting-out rotors are connected together, shorting out all unused coils. This helps prevent dips in the output due to resonances and stray coupling.

SWITCH ON SPACERS

The switch is attached to the front of the RF chassis by two ¾-inch spacers. The original assembly screws of the switch were removed, and 3-inch studs inserted. The studs thus both hold the switch together and attach it to the channel. This enables the switch to be moved back to the centre of the channel, the insulating shaft extension protruding through a 5/8-inch hole. Switch leads are thus kept to a minimum.

The coils are wound on 7/16-inch bakelised paper formers which are provided with iron-dust slugs, and are arranged concentrically around the switch. The slugs allow the low end of each band to be adjusted to suit a calibrated scale. For calibration of the high ends, small ceramic trimmers are mount-

AWA FOREMOST IN SOUND

20 WATT AMPLIFIER
MODEL PA.872

A.W.A. Sound Amplification and Distribution Systems are in wide use throughout the Commonwealth for Schools, Hospitals, Cathedrals and Churches, Retail Stores, Public Halls, Hotels, Restaurants, Racecourses, Sports Grounds, Surf Clubs, Railways, Theatres, Factories, Canteens, Business Houses, Amusement Centres, Tourist Coaches, etc.

Whether your need is for fidelity musical entertainment, effective public speaking or clear industrial communication and direction you will be served faithfully by this newly designed compact and powerful unit.

Manufactured to Broadcast Equipment Standard.

The Range of A.W.A. Audio Amplifiers, Microphones and Speakers provides a type for every purpose with features and facilities to meet every need in Sound Amplifying and Distribution.

Manufactured and Guaranteed by:

AMALGAMATED WIRELESS (AUSTRALASIA) LTD.

554 PARRAMATTA RD., ASHFIELD, UA0791 — 167 QUEEN ST., MELBOURNE, MU9161 — CNR. WILLIAM and NEWCASTLE STS., PERTH, 28-3426.

Available in other States from
NEWTON McLAREN LTD., ADELAIDE — CHANDLERS PTY. LTD., BRISBANE
and from leading wholesalers.

This view shows the interior of the RF oscillator channel chassis. At the right is the tuning capacitor, mounted on its side, and alongside it is the valve socket, positioned with the gap facing the switch. The switch itself, with the coils and trimmers mounted concentrically around it, is visible at the left. — Note particularly the lead through capacitors conveying the heater and audio leads from the chassis.

ed adjacent to each coil, and connected from the grid ends of the coils to earth.

The formers used in our unit were made by Telecomponents Pty. Ltd., of Brookvale, N.S.W. At our suggestion they intend to make them available through the trade for the benefit of home builders. They should be a useful component wherever a coil has to be wound experimentally, with the advantage that the iron core may be used for the final adjustment.

As the photograph shows, the range switch was orientated so that the pole lugs were nearest to the plate and grid pins of the oscillator valve, to minimise lead length. Similarly the high frequency bands are nearest the pole lugs.

Now for the coils themselves. The four lowest bands were provided by rummaging through the junk-box and salvaging the honeycomb windings from damaged IF transformers. In particular we sought those having 7/16-inch formers, the same size as the commercial formers already mentioned.

UNIFORM COILS

This permitted the required windings to be gently slid off the old former and, without damaging the turns, slid on to the new former. This is a convenient way of making up a set of coils on a uniform set of formers.

The band from 160 Kc to 480 Kc was provided by a winding from an old 175 Kc IF transformer. When slipped on to the new former, it tuned rather low in frequency, and we found that about 50 turns had to be removed to give the correct coverage. The exact number of turns to be removed will depend on the particular coil used, and is a matter for trial and error.

The next band, covering from 470 Kc to 1500 Kc, was covered by a winding from a rather ancient 455 Kc IF transformer. This winding covered the band without modification, and was duly cemented intact to the new former.

The third band, tuning from 1.2 Mc to 3.5 Mc, was a little more difficult. Finally we found that by stripping a little more than half the turns from a 455 Kc transformer winding similar to that used above, the desired range was reached.

Similarly, for the next band of from 2.5 Mc to 7.5 Mc we found that the most convenient way of obtaining the desired range was to again attack a 455 Kc IF winding. In this case approximately three-quarters of the winding had to be removed to achieve the desired range.

Pantechna Pty. Ltd. present now the most advanced tape recorder programme ever.

TWO FOUR-TRACK STEREO RECORDERS

No add-on Units required. Also record and play mono. 8 hours playing on 7in. reel at 3¾ ips.

From Pantechna Pty. Ltd. come today's most advanced Continental tape recorders, both with their own special features that will be modern for years to come. With these machines, live stereo recording becomes as practical and as simple as single-channel operation, and you don't need an add-on unit to do it. Used monaurally, you make a fabulous saving as tape costs for each reel gives twice the playing time obtainable from a conventional mono instrument. Thus 8 hours playing from a 7in reel at 3¾ ips is possible, and the heads and amplifiers used in these models ensure the highest standards of reproduction. Many other advantages are offered particularly for home movie and projector fans and are described in the leaflets available.

HARTING HM8.

4-track, 2-speed recorder (7½ and 3¾ ips.) with two speakers (one in lid) for direct stereo replay. Overall response 30-20,000 c/s. Heavy Ingel motor, Telefunken heads, pause, superimpose and monitor facilities, etc.

KOERTING MK.128

4-track single speed recorder (3¾ ips.). Telefunken heads, built-in speaker. Dual amplifiers for record and playback. Overall response 30-16,000 c/s. 5 watts total output. Superimpose, pause, etc., etc. Heavy duty Alcomax motor, 7in. reels.

We also import the superb Empire and Grado cartridges and arms as advertised this month.

Sole Australian Agents:

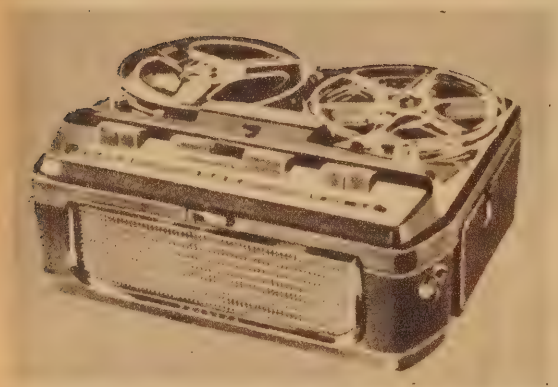
PANTECHNA PTY. LTD.

6a Elizabeth Street, Melbourne, C.1. Phone MF 8811

Distributors for N.S.W.: AUDIO ENGINEERS PTY. LTD., 422-4 Kent Street, Sydney.

TAPE RECORDERS on 12 Months Guarantee

This offer is exclusive to Magnetic Sound Industries and DEFINITELY unobtainable elsewhere.



PHILIPS PRESSBUTTON 3 HOUR RECORDER

Thousands of hours of wonderful music or home entertainment is yours for only a few shillings a week. The Philips records at a speed of 3¾ i.p.s. and has a frequency range 50-16,000 c.p.s. A free radio input lead is provided and the recorder comes to you complete with microphone and tape and — most important — our own 12 months' guarantee.

99gns.

£10/19/- Dep.

PHILIPS 3 SPEED STEREO OUTPUT RECORDER

Tape record your favourite music from radio or records, or even singing and piano playing, with lifelike brilliance. Also the latest stereo tapes can be played with this remarkable machine. Up to 16 hours playing on one reel of tape. Comes to you fully complete and — most important — with our own 12 months' guarantee.

149gns.

£16/19/- Dep.

CLARION TRANSISTOR TAPE RECORDER

Weighs a mere 5lb; records and plays back anywhere — 50 hours' recording on one set of 4 Torch Batteries; can even be used as a Public Address System.

Only 52gns. complete

£12/10/- Dep.

TELEFUNKEN

TELEFUNKEN for the man who demands the best. 4 tracks, 2 speeds and up to 13 hours' playing. 155 gns. 2 Track Model, 135 gns. Push button control variable track button — automatic stop at end of tape — special Tape Counter — Built in Mike Pre-amp for condenser or crystal mike. 12 months' Guarantee and free service.

TELEFUNKEN Twin Channel 14 Combination Mixer for Mike, Radio and Tape Recorder £8/15/-.

GRUNDIG CUB TAPE RECORDER

A Transistorised Tape Recorder
3¾in IPS. Complete with Tape and Mike.

PRICE . . . APPROX. £65

£12/10/ Dep.

TAPE RECORDER SERVICE

Free Metropolitan Pick-up and delivery.
Every repair guaranteed for 3 months.

WRITE FOR FREE PAMPHLETS.

Magnetic Sound INDUSTRIES

387 GEORGE ST. (2 doors from Kodak). BX4440, BX4587

The fifth band, covering from 6.5 Mc to 23 Mc was quite an easy one. Using 18 gauge (B and S) enamelled copper wire we close-wound 16 turns on to the former, cementing it into position. This coil gave the correct range without further modification.

The final band, tuning from 22 Mc to 90 Mc, was obtained with a coil made by winding 3 turns of 18 B and S enamelled wire over a distance of 3/8 inch on the former.

The foregoing will enable almost anyone to produce a satisfactory kit of coils from a few old windings, some new formers and a little patience. However, we are hoping to persuade at least one manufacturer to market a complete kit of coils to these specifications which, we feel, would fill a definite need on the part of the home builder.

TURN SWITCH

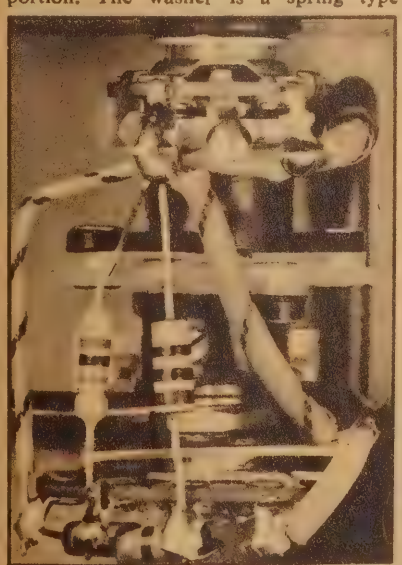
When wiring the coils and trimmers to the range switch, it is a good idea to turn the switch to the particular position being wired. This can be very helpful, and help prevent making wrong connections due to confusion of contacts.

The tuning capacitor is a miniature 2-gang type, mounted on its side. This was done to shorten the leads from its stators to the switch pole lugs. The actual gang used was a Roblan type RMG2, having an approximately "H" law and a capacitance range of 10-415 pF. We mention this to allow readers to use a gang which will facilitate the use of a ready-made scale on the instrument.

A point which bears mentioning here concerns the RF ceramic trimmers and their mounting arrangements. The units used in the prototype were supplied by the United Capacitor Company Pty. Ltd., and are designated type CC175N. They have a range of from 2 to 20 pf and are distinguished by a black dot.

To mount them, a square hole about 3/16-inch a side is cut in the chassis. Into this hole fits the square end of the ceramic part of the trimmer. From the other side of the chassis the washer and screw is then threaded into the ceramic portion. The washer is a spring type and tightens against the chassis, both fixing the trimmer and locking the screw in the desired position.

The screw is not completely locked, and thus can be adjusted to alter the capacitance, but is held firmly in position and prevented from loosening.



The RF attenuator network is normally enclosed in a shield box made from sheet copper. The switch is coupled to a shaft provided on the pot.

The output from the oscillator is taken via a 0.001 mfd disc ceramic capacitor from the plate, and then through a length of PT9M co-axial cable to the attenuator beneath the chassis. The junction of the cable and the capacitor is supported with a ceramic standoff insulator, to ensure rigidity.

The coarse and fine controls for the RF attenuator are mounted concentrically. This is to conserve panel space, as too many controls tend to make a panel appear cluttered. It is made possible by the use of a potentiometer provided with a concentric shaft wihch protrudes out the back.

This unit was supplied to us by Ducon Industries Ltd., and is similar to the one used in the 3-inch C.R.O. of August. However, it is much lower in value, being a 500-ohm carbon type.

The coarse attenuator control is a single pole 3 position rotary switch mounted on a small aluminium bracket. A flexible coupling (with a ¼-inch to 3/16-inch conversion sleeve) is used to couple the switch to the rear shaft of the pot. The fixed resistors of the attenuator network are supported by the switch and the pot.

A shield box made from sheet copper fits over the complete attenuator circuit and prevents stray radiation. Measuring 2in x 2in x 2⅝in, it is only four-sided, fitting snugly against the chassis and front panel.

As the under-chassis view shows, the valve shield comes quite close to the attenuator shield box. Care should be taken to see that the two do not touch, as this would probably cause RF chassis currents and result in increased leakage radiation.

Incidentally, the shielding braid of the co-axial cable going both to and from the attenuator circuit, should not be earthed at the attenuator. As the circuit shows, the output socket, braids and attenuator resistor network are all connected together, and are earthed only at the oscillator end, on the RF chassis. The attenuator shield box is isolated from this circuit, it being earthed directly to the chassis.

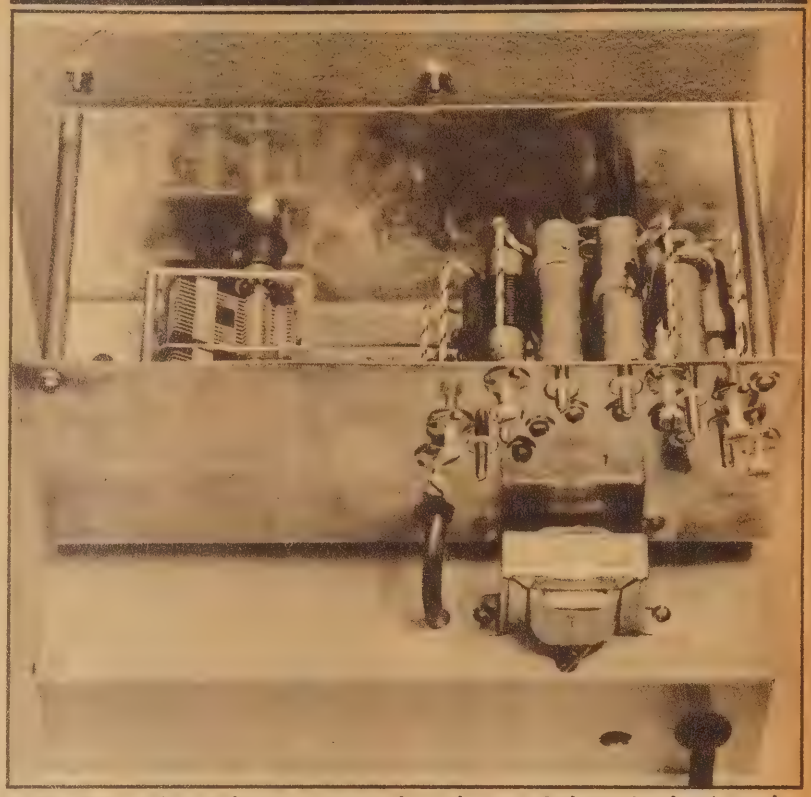
PREVENTS FLOW

The important point to note here is that the RF output socket is insulated from the chassis, as it is connected to the shielding braid of the co-ax. In this way, the RF currents are confined to the actual cable and attenuator system, and prevented from flowing through the chassis.

The combined mains and modulation switch is a 3 pole 3 position rotary type, mounted conventionally on the front panel. The 3 positions are labelled "OFF-CW-MOD."

The power transformer is a small 150 volts aside 30mA type, and is mounted

REAR VIEW OF THE OSCILLATOR



The R.F. oscillator chassis is mounted on the top of the main chassis, and is shaped so that by the addition of a U-shaped bracket, it can be made into a complete shield box. The transformer for the AF oscillator is mounted behind it.

NEW *Releases!*

IN HI-FI TAPE RECORDERS

THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL ROLA SPEAKERS.

The amplifier incorporates the latest "Mullard" tape recorder circuit equalised to C.C.R. standards giving perfect reproduction from recorded tapes. Outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator. Amplifier is completely shielded and fitted with perspex dress plate to match deck. Output: 4 watts can be used as straight amplifier if required.

Model TR2 incorporates the new Collaro "Studio" Deck which features:—

- **High Fidelity. Frequency response 40 to 12,000 cycles at 7½in per second.**
- **Three 4-pole shielded motors.**
- **Three speeds, 1-7/8, 3¾ and 7½.**
- **Fast forward and rewind, 1200 ft in 65 seconds.**
- **Two track.**
- **Light piano key controls.**
- **PAUSE CONTROL**
  This has the effect of stopping the transit of the tape past the "Record/Playback" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected positions. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.
- **TAPE MEASURE AND CALIBRATING DEVICE**
  The three digit counter makes the location of any recorded passage the simplest of operations.
- **TRANSCRIPTION TECHNIQUE**
  A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter at less than 0.15 per cent at 7½in per second.

COMPLETE RECORDER WITH MIKE 69 GNS. f.o.r.

A NEW POPULAR PRICED RECORDER AT 49 gns. f.o.r.

MODEL TR3. For this recorder we have chosen the new English B.S.R. deck. This is a two track single speed unit (3¾in per second) giving two hours' playing on a 5¾in long play tape or one hour on a standard 5in tape.

Automatic locking device prevents accidental erasure. Frequency response 60 to 8,000 cycles.

The five valve amplifier including "magic eye" level indicator has two inputs, for microphone, radio, or pick-up; and outputs for external amplifier or speaker, equalised to C.C.R. standards. Can be used as straight amplifier if required. Output 3 watts.

The recorder is fitted in attractive two-tone case with dual speakers and microphone.

Overall dimensions 14in x 10in x 6½in. Weight 26lb.

CLEARANCE OF HI-FI STEREO EQUIPMENT

SIX ONLY 13 VALVE SUPERSEDED DUAL WAVE STEREOGRAM CHASSIS FEATURING R.F. STAGE, PUSH-PULL OUTPUT USING 6BM8 VALVES GIVING 7 WATTS PER CHANNEL. FREQUENCY RESPONCE 40 TO 12,000 CYCLES. SUPPLIED COMPLETE WITH VALVES AND TWO ROLA 12PX SPEAKERS **£48/15/- f.o.r.**

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

CLASSIC RADIO TAKE PRIDE IN ANNOUNCING COMPLETE NEW RANGE OF STEREOPHONIC EQUIPMENT

Stereophan LIVING SOUND

16 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo, comprising a compact Hi-Fi Stereogram in two units featuring a high gain dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls in one unit and two Mullard 5-10 amplifiers with push-pull outputs and power supply on second chassis. **£69/15/-** F.O.R.

Two pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts). Frequency response of amplifier 40 to 15,000 cycles.

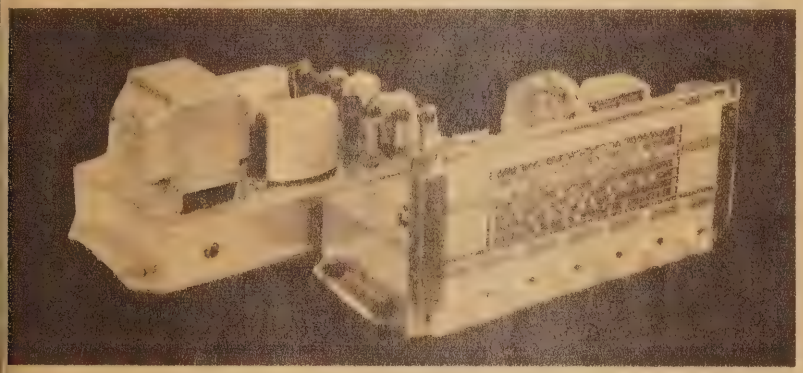
THIS UNIT CAN NOW BE SUPPLIED WITH THE NEW ROLA 12 PX SPEAKERS

10 VALVE HI-FI STEREOGRAM CHASSIS

Complete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX speakers. Power output 4 watts per channel. Frequency response of amplifier 40 to 15,000 cycles. **£49/15/-** F.O.R.

8 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo incorporating the "Mullard 2-2" amplifier circuit with separate bass and treble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 10,000 cycles. **£41/15/-** F.O.R.



ALL UNITS INCORPORATE THE NOW FAMOUS "MULLARD" AMPLIFIER & TONE CONTROL CIRCUITS.

Write for Full Specifications of STEREOPHONIC EQUIPMENT OR TAPE RECORDERS

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

NEW:

Ultramodern circuit using high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short-wave range of 12,000 miles. All valves used are the new Mullard nine-pin Innoval series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving plus or minus 15 db boost or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual speaker combination using the new Jensen M.S.P. 12PR woofer with matched tweeter and cross-over network giving a frequency response of 40 to 12,000 cycles. If required the Rola 12MX speakers can be supplied (with the 8 valve stereo chassis, two Rola 8MX speakers are supplied). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial can be supplied in cream or black with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.
All chassis are wired for the fitting of F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.
Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

COMPLETE RANGE OF DUAL, COLLARO, B.S.R. AND GARRARD, STEREO PLAYING EQUIPMENT IN STOCK

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

TELESCOPES

30 Power Coated Lens. Brand new, £3/19/6.
30 x 40 with Tripod, £7/19/6.
Post: 5/; Int., 7/.
60 magnification with a 60mm coated objective lens with tripod. £17/10/

CHASSIS

RT24/APX2 or B/APX1 15 miniature seven-pin ceramic valve sockets and covers, trannies, etc.

45/- each

FIBRE PULLEYS (AMERICAN)

BALL BEARING.
1 3/8in diam., ¼in shaft, 30/ doz.
1¾in diam., ¼in shaft, 42/ doz.
2 3/8in diam., 3/8in shaft, 54/ doz.
3½in diam., 3/8in shaft, 66/ doz.
Add postage.

OIL PRESSURE GAUGES

New. Suit cars, trucks, boats, stationary motors, etc.
0-150lb per sq. in.

£1 each

Complete with tubing.
Post: 2/6; Int., 3/.

P8 COMPASS

Liquid filled. As new.
Ex-R.A.A.F. Ideal for small boats, etc.

£3/19/6 each

Post: 7/; Int., 9/6.

PRISMATIC MONOCULAR

8 x 30. Ideal for races, football or general viewing. This is the monocular that is used as a telephoto camera lens, with leather carrying case.

£5/19/6

Post: N.S.W. 4/6; Int. 5/.

PRISMATIC COMPASS

Ex-Army, LUMINOUS.
Guaranteed Correct.

£5/15/- each

Post: N.S.W., 4/6; Int., 5/.

VOLTMETER

Pocket Size
0 to 15 volt DC and 0 to 220 volt DC, with probes. In waterproofed Canvas Case.

33/6 each

Post: 3/; Int., 4/.

AIRCRAFT CLOCKS ELGIN

8-DAY.
Ex-Rolls-Royce Merlin. with sweep second indicator.

£4/15/- each

Post: N.S.W., 4/6; Int., 5/.

CRYSTALS

New in the following frequencies: Kc's 5397.5, 5852.5, 5205, 5660, 4840, 5295, 4495, 4950, 5327.5, 5782.5, 4397.5, 4852.5, 5780, 6235, 5920, 6375, 25/ ea., complete coil and crystal units for walkie-talkie (SCR536), new £2/10/ per set. Add postage.

EISEMANN MAGNETO

U.S.A. Suit twin or single cylinder engine. Brand new.
COST £30.

£9/15/-

Post: N.S.W., 7/; Int., 9/6.

American WALKIE-TALKIE with all valves, crystals, coils and batteries.

Each **£7/19/6**

Post: 7/; Int., 9/6.

Mechanical REV. COUNTERS

BENDIX.
New, 0 to 3,000 r.p.m.

£4/19/6 each

complete with flexible drive.
Post: N.S.W., 4/6; Int., 5/.

METERS

In polished wooden case. Dimensions 7½in x 7½in x 4½in.
Siemens 0-50 AC amps, 50 cycle.

£7/5/-

SUPPLY RECTIFIER UNIT No. 13, NEW

INPUT. A.C.V. 240, 230, 220, 210, 200v. Also 100, 110, 120, 130v.
OUTPUT D.C.V. 24v D.C. Tapped to give 2 at 12v D.C., 3 amps output. Voltage output can be increased in small steps to 28v D.C.

£12/10/- each

Freight payable at nearest Attended Railway Station.

MOTORS

24v, ¼ h.p.
Double sprocket geared. Ideal electric control anchor winch, invalid chairs, etc.

£4/10/- each

VALVES, NEW

6C4	7/6	9006	15/
6J6	15/	83	9/6
6AG5	7/6	6J7G	11/6

Add postage.

DRIFT SIGHT

Canada Mk. II contains these lenses: 2 acromatic 1¼in diam., 5in focal length, 1 Bi-convex 2in diam., 9in focal length, 1 plane convex., 2in diam., and 9in focal length, 1 small elliptical mirror, minor axis 1 7/16in, 1 flat optical front silvered mirror, 1¾in x 2 7/8in, 1 4in ground glass disc and sundry parts, etc., 42/6 ea.
Post: N.S.W., 7/; Int., 9/6.

POCKET MICROSCOPE

X10 ILLUMINATED.
Beck, London.
Complete with Battery.

39/11 each

Post. N.S.W., 2/6; Int., 3/.

AIR SPEED INDICATORS

NEW.

8/6

Post: N.S.W., 2/6; Int., 3/.

BOOSTER COIL

For racing enthusiasts, 12 or 24v Bendix. New, type 512, platinum points.

22/6 each

Post: N.S.W., 2/6; Int., 3/.

FULLY GEARED BASE

Full Azimuth circle with elevation and depression rating. Has diamond set balance. Ideal dumpy base.

£4/15/- ea.

Post: N.S.W., 7/; Int., 9/6.

MODULATION TRANNIE

and driver (522, 160 and 116), 45/.
Post: N.S.W., 7/; Int., 9/6.

NATIONAL TRANSFORMER FOR SCOPE SOLDERING IRON

Prim. 240v. 50 cycle
Sec. 3.3v. 30 amps.

NEW 38/6 each

Post N.S.W. 5/.
Int. 7/6.

522 TRANSCEIVER

Complete £12/10/; 522 Transmitter, £6/15/; 522 Receiver, £6/15/; 522 Chassis,

45/-

COMPLETE TRANSMITTER NO. 153

A.W.A. type J51050 comprising R.F. unit, power control and minor rectifier unit and main rectifier unit, with spares. 100 watt R.T. 300 watt C.W. Crystal controlled 2 to 20 megs, with power supply. 110 or 240 volt A.C. 50 cycle. New. Will transmit over 500-mile range daytime. World range night. Original cost £2,000. Heavy-duty wide band aerial included.

£125 COMPLETE

SECOND HAND £75 each

TELEPHONE SETS

Ex. P.M.G. Wall-type. Complete with Magneto Box. Battery operated. Ideal long distances.

£4/15/- each

or £9 pair

Freight payable at nearest attended Railway station.

TELEPHONE HANDSETS

NEW SOUND POWERED.
No battery required. Ideal television installation inter-com., field telephones, etc.

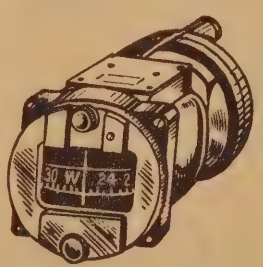
55/- each

or £5 a pr. Post 5/; Int., 6/.

MANIFOLD PRESSURE or VACUUM GAUGE

£1 each

NEW.
Post: N.S.W., 2/6; Int., 3/.



Dashboard COMPASS

Small ships, Pioneer American. Liquid Damped with Light. Also suit as car compass.

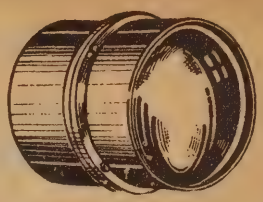
£9/17/6

COMMAND RACKS

Receiver 3 tier, 19/6 ea.
Transmitter, 2 tier, 15/ each.
Post: 3/; Int., 4/.

WINCHES

2-ton Dawn. New. Hand-operated. Complete with steel cable. £35. Freight payable at nearest attended railway station.



CONDENSER LENSES.
3½in WITH CELL.

£3/15/-

Post: N.S.W., 7/; Interstate, 9/6.

LENSES AND PRISMS

Lens Cell and Filter, 2 5/16in dia., 25/ ea.
Eyepiece, low power, 1¼in F.L., £3 ea.
Eyepiece, high power, 5/8in F.L., £4/10/ ea.
Right-angle Prism, 2¼in square face ..... £3 ea.
Small Erecting Prism ..... £1 ea.
Large Erecting Prism ..... 25/ ea.
Add Postage.

GEARED ROTATING BASE

6¾in diam., full azimuth circle with Surveyor's Compass.
£4/15/ ea.
Post: N.S.W., 9/6; Int., 12/.

PERISCOPES

10in x 4in x 1¼in. Contain two front silvered mirrors, 3½in x 1¼in x 1/8in.

12/6 each

Post: N.S.W. 3/; Int., 4/.

MICROMETERS

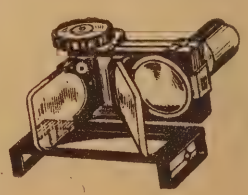
0 to 1in, Starrett, Moore and Wright.
Perfect Order.
Post: 3/. **75/- ea.**

RANGEFINDER MK. V

BARR AND STROUD.
4ft. long tubular type.

£12/10/- each

Freight payable at nearest attended Railway station.



GUNSIGHTS

Contain these lenses:
1 lens 1in Focus, ½in diam.
1 Lens 1 11/16in Focus, 1¼in dia.
1 Air Spaced Lens, 1¼in diam.
1 Filter Lens, 1 Graticule,
1 Lampholder.

18/6 each

Post: N.S.W., 2/6; Int., 3/.

ASTRO COMPASS

(Boxed). New Condition.

£3/5/- each

Post. N.S.W., 5/; Int., 7/6.

DEITCH BROS.

70 OXFORD STREET, SYDNEY Between Crown and Riley Streets, City.

beneath the chassis on its side, to conserve space. Only one half of its secondary is used, being connected in a voltage-doubling circuit with two INI764 silicon diodes. The power supply circuitry is placed at one end of the tagboard visible under the chassis.

Note here that the 10K resistor common to the RF and audio oscillators is a 5 watt type, and is mounted on the tagboard alongside the 1.5K filter resistor.

The other end of this tagboard is used to mount the components of the mains filter, and to form a termination for the mains cord. The centre of the board is used to mount the audio oscillator components, apart from the actual transformer, which is mounted above the chassis, visible at the rear of the oscillator channel.

AVOID DAMAGE

Incidentally, when soldering the silicon diodes for the power supply in position, be sure to use a pair of pliers as a heat sink, by using them to grip the diode pigtail. This prevents possible damage to the diode from overheating.

The RF chokes used in the mains filter are standard single-winding types. The ones used in the prototype were Q-Plus type RFC 1 units, with an inductance of approximately 1 millihenry.

An important point to note about the capacitors used in the mains filter is that they are 600 volt working types. If lower voltage rating types are used, they may break down due to the high peak voltages involved.

As is normal practice, the mains cord is introduced under the chassis via a grommeted hole, to prevent chaffing and possible shorts. Since space is at a premium, the cord was not knotted, but bound with cord to anchor it and prevent strain on the connections.

As can be seen in the first photograph, the tuning dial used in the prototype is a commercial unit. It measures 4½in x 3in, and consists of a sheet of perspex covering a sheet of cardboard bearing printed scales. No calibrations are given on the scales, the dial being intended for individual calibration.

However, we intend to calibrate the instrument very shortly, and we will endeavour to publish a full-size replica of the final scale in the next issue. This should be of considerable assistance to readers unable to gain access to calibration equipment.

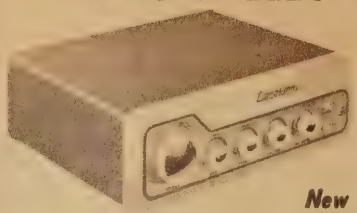
ACCURATE CALIBRATION

For readers who are in possession of suitable equipment, this will not be necessary, as they will be able to make their own scales. Thus readers who have available a calibrated frequency meter or wavemeter will find accurate calibration quite easy.

A grid-dip oscillator can be used to calibrate the instrument, in the absence of these two instruments. The procedure here is to find the resonant frequency of the tuning circuit at each dial position with the oscillator turned off. This is the same frequency as that at which the oscillator will function.

This concludes the description of the oscillator. Next month we will discuss calibration of the unit and briefly describe its use in alignment of broadcast receivers and similar equipment. We also hope to be able to include a full-scale replica of the final dial scale.

ARROW ELECTRONICS PRESENTS:



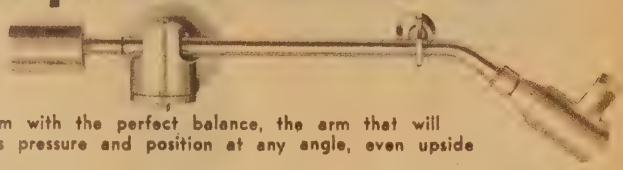
Pamphonic stereo

New components for finer stereo listening

PAMPHONIC STEREO AMPLIFIER MODEL 3001

A new integrated amplifier, for shelf or panel mounting, with provision for magnetic or crystal pickups, stereo radio or tape. Fully variable bass, treble and balance controls, supplied complete in attractive shelf mounting cabinet, with all hardware necessary for panel mounting.
Here is an amplifier of tremendous potential. Compact in size, big in performance, allowing for all future possible extensions, this amplifier is a MUST for your new stereo system.

new Empire 98 STEREO/BALANCE ARM



The pickup arm with the perfect balance, the arm that will maintain stylus pressure and position at any angle, even upside down.
Finished in matte, chrome or gold, this arm is the answer to your pickup problems.
Accommodates all standard cartridges.
Tracking weight readily and precisely adjusted without the need of special gauges etc.
Removable, positive lock head shell.
Arm resonance below audible threshold.
Self-latching arm rest.

£31/13/-

new Empire 88 STEREO/BALANCE CARTRIDGE

Frequency response 20 — 20 Kc.
Moving magnet system eliminates hum pickup, allows low effective tip mass, and high compliance.

£18/2/-

THE GRADO MASTER CARTRIDGE

Utilising the moving coil system this cartridge has a frequency response of from 20 cps to 30,000 cps, and a stylus tip mass of .8 milligrams!! The absolutely level and wide frequency response gives this cartridge a superb performance, in fact, all who hear it acknowledge that it is the finest cartridge available.

£42/8/-

ALSO AVAILABLE: The Grado transcription arm, accommodates all standard cartridges, provides true balance in all directions.

£26/8/-

OTHER ARROW SPECIALS:

Electrostatic Tweeters; Response up to 20 Kc.
Model LSH 100, 20 watts, 20/.
Model LSH 518, 6 watt wide angle, 17/6.
Model LSH 75, 6 watts, 12/3.

LEVEL INDICATORS — **STEREO BALANCE METERS**
In panel mounting or portable cases, £6.
NOTE: These are two separate meter movements with individual pointers reading on two scales, side by side, and include a special internal calibration facility, and separate sensitivity adjustment.
Mono Level Meters, for one channel, £3/9/6.

INTERESTED IN SOUND? See ARROW ELECTRONICS for all your requirements. We stock a full range of equipment; Goodmans, Wharfedale, Rola, Magnavox loudspeakers, Leak, Quad, Rogers, Harman-Kardon, Grampian amplifiers, Thorens, Ortofon, Garrard, Neat, Decca and Dual record playing equipment, together with a range of tape recorders, tape and accessories, cabinets and all necessary components for stereo or mono reproduction.

ARROW ELECTRONICS PTY. LTD.

A member of the AE group of companies.

422 KENT STREET, SYDNEY — BX6731

SCOPE

"SUITS ME"

IT'S FAST

I don't have to wait with **Scope** . . . the soldering iron that's hot in 6 seconds! **Scope** is fast working . . . the heat is generated directly at the tip, which then conveys it to my work.

*The **Scope** small tip does not lose heat into the work . . . I get fast, accurate soldering even in confined spaces.*

***Scope** is safe . . . operates on the 3.3 volts supplied by the National Scope Transformer, yet gives the same performance as an iron rated to 150 watts. **Scope** is light . . . weighs only 3½ ounces.*

SCOPE LABORATORIES MELBOURNE

SCOPE SOLDERING IRON

AVAILABLE FROM ALL ELECTRICAL TRADE SUPPLY HOUSES

AUSTRALIAN AND OVERSEAS AGENTS:
WM. J. McLELLAN & CO. PTY. LTD., 126 SUSSEX ST., SYDNEY. BX 1131
VICTORIA: AUSTRALASIAN ENGINEERING EQUIPMENT CO. PTY. LTD., 202 BELL ST., PRESTON

MSA1016

FROM THE SERVICEMAN WHO TELLS

It seems that one of the penalties of progress, at least in the world of electronics, is that each major advance produces problems of standards, interchangeability, or compatibility. Valve type numbers, TV standards, recording curves, stereo standards, etc., all passed through a period of confusion before general agreement was achieved. And right now, the same thing is happening with transistors.

READERS may remember that late last year (December, 1959) I discussed some aspects of transistor servicing and mentioned, among other things, the problem of replacements for Japanese transistors encountered in many imported portable radios.

At the time I was able to reprint a small table listing a few equivalents and near equivalents of Japanese transistors, kindly passed on to me by one of the local transistor manufacturers. However, the list was pitifully small, and the local manufacturer who supplied it pointed out that information of this kind appeared to be extremely rare.

INDEPENDENT DEVELOPMENT

The exact reason for this is not clear, except perhaps that the Japanese manufacturers have been content to develop their own ranges without too much regard to what is being produced in other countries. Similarly, Europe and America have developed their particular types, and everyone appears to have been so busy with his own developmental work, that nobody has bothered to attempt any degree of standardisation, or interchangeability between different manufacturers' types.

Anyway, whatever the cause, the result has been a certain amount of chaos, to put it mildly. No real trouble occurs while complete receivers remain within the general region of their manufacture, but when they suddenly turn up in a strange land, half way across the world, they are indeed in a "foreign" country. This is particularly so when the set is an isolated unit brought home by a tourist, rather than one of a large batch imported by someone who can organise a supply of spares.

INQUIRIES

The fact that isolated receivers do create service problems was emphasised after the December, 1959, article referred to above, there being quite a number of inquiries directed to the "R, TV and H" office concerning suitable replacements for previously unheard of Japanese transistors. Unfortunately, there was very little that could be done, the information already published representing about all that was available.

This situation was recalled to me recently as I was browsing through a copy of the American magazine, "Electronics World," and came across an article by a serviceman dealing with exactly the same problem. I found it more than usually interesting for several reasons, not the least being that it emphasised that the problem is by no means unique to Australia. It would appear that equivalent type lists are just as rare in the U.S., and the incidence of "foreign" portables, with their attendant replacement problems, as high or higher.

The second point of interest was a quite comprehensive list of Japanese equivalent or near equivalent types which obviously had taken a good deal of compiling. For that reason alone I determined that the article should be filed along with other similar data already on hand.

And, finally, I felt that the author's description of how he deals with the replacement problem when exact equivalents are not available, at least provided food for thought. After all, in any such situation, one has to start somewhere, usually by making certain assumptions which, at best, can be only approximations. Any scheme which allows these assumptions to be applied logically, and then followed up with what ever adjustments appear necessary, is worthy of consideration.

Considering all these points I felt that the substance of the article, at least as far as it applied to this country, was worth repeating. I have therefore extracted the most interesting portions, and the most useful tables, etc., and reproduced them for the benefit of local servicemen.

After quoting export and import figures which apply essentially to the U.S., the author, Mr D. Lewis, goes on to discuss the replacement problem as follows:

"For replacement purposes, most components or acceptable equivalents can be obtained from local suppliers. Unfortunately this is not true of the transistors themselves. In addition, there are many transistor types used in the imported sets rather than a relative handful.

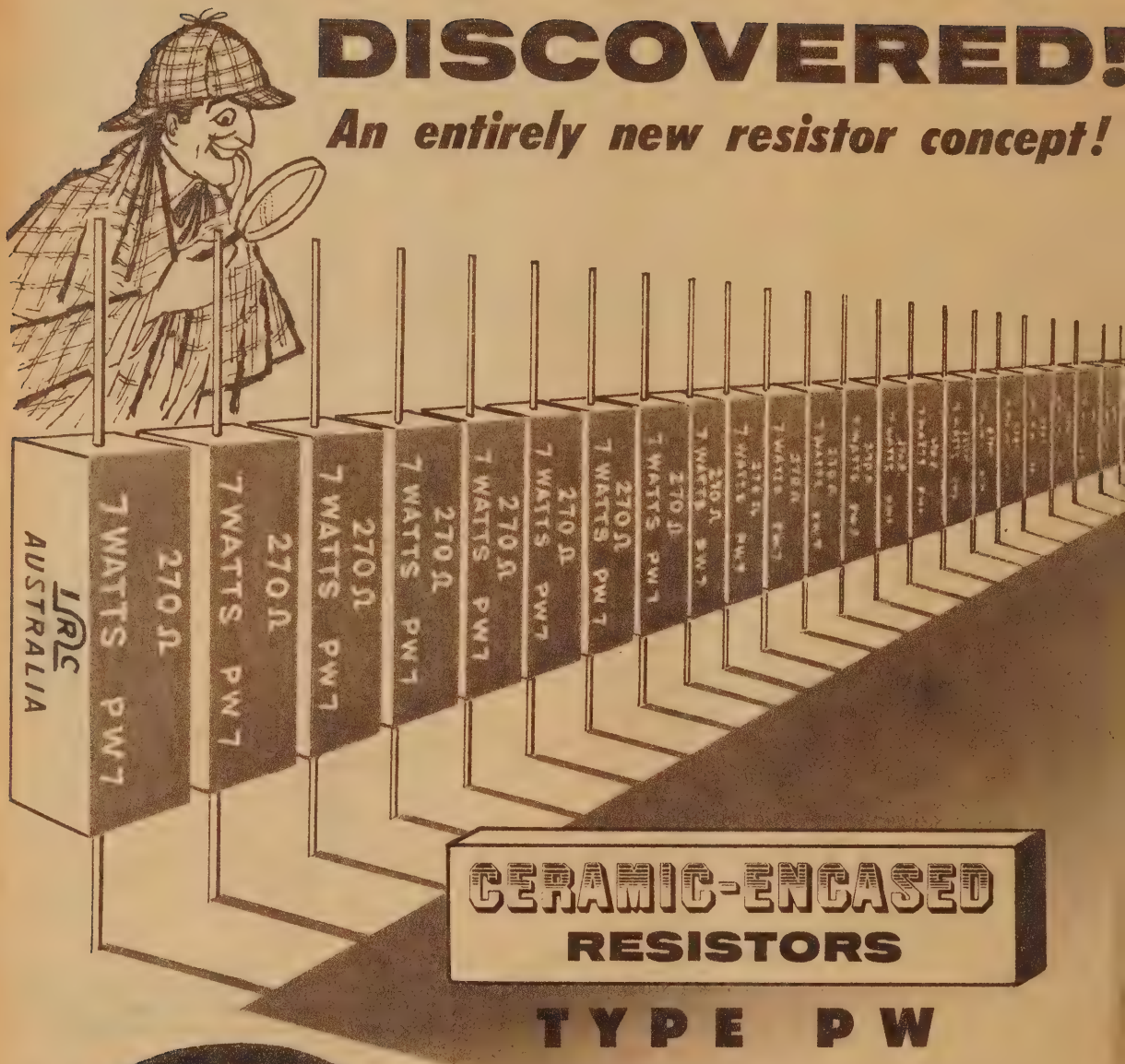
"Among the large manufacturers — this includes, Hitachi, TEN, Sony, NEC, and Toshiba—each has its own numbering system. To complicate matters, none of these appears to be related to the domestic JEDEC code, in which all manufacturers use type numbers beginning with the "2N" prefix.

"There is a slight exception with respect to Hitachi. This company seems to be under licence by RCA, for many Hitachi transistors duplicate the RCA line and use the same type numbers, particularly in the 'drift' series (such as 2N370 and 2N544). However Hitachi seems to have increased confusion rather than reduced it with its other types.

"This company used to use a code involving two letters followed by two numbers (for example, HJ72). It has recently switched to a system in which the prefix '2S' is followed by three digits. Thus what was formerly desig-

Japanese No.	Similar U.S. Type
HITACHI	
HJ15	2N215
HJ17D	2N217
HJ22D	2N218
HJ23D	2N219
HJ32, HJ70, 2S141	2N370
HJ34, HJ34A, 2S91	2N270
HJ35	2N301
HJ37, HJ71, 2S141	2N371
HJ50	2N215
HJ51	2N408
HJ55, HJ60, 2S146	2N219
HJ56	2N410
HJ57	2N412
HJ72, 2S142	2N372
HJ73, 2S143	2N373
HJ74, 2S144	2N374
HJ75, 2S145	2N544
NEC	
ST28C	2N309
ST37D	2N252
ST162	2N145, 2N146
ST163	2N147, 2N293
ST173	2N168A
TOSHIBA	
2S44	2N217
2S45	2N218
2S52	2N219
2S56	2N270
TEN	
2S30	2N411, 2N412
2S31	2N409, 2N410
2S32	2N405, 2N406
2S33	2N407, 2N408
2S34	2N270
2S35	2N140, 2N219
2S36	2N139, 2N218
2S37	2N109, 2N217
2S38	2N270
2S39	2N175, 2N220
2S40	2N269
2S41	2N301
2S42	2N301A
2S43	2N247
2S109	2N370
2S110	2N371, 2N372
2S112	2N372
SONY	
2T64	2N366, 2N228
2T65	2N366, 2N228
2T66	2N365
2T76	2N147

Since many American transistors are used in this country, this list of equivalent and near equivalent Japanese types should prove extremely valuable to local servicemen. The text suggests how best to use this information in practice.



DISCOVERED!

An entirely new resistor concept!

CERAMIC-ENCASED RESISTORS

TYPE PW

IRC proved their leadership in the resistance field with the development of their PW ceramic-encased, wire-wound resistor—an IRC exclusive. This is a low-cost, quality resistor that allows close stacking, installation next to metal components, no ageing worries, no storage problems; it resists overloading and, with the true coaxial leads, an IRC "First," definitely overcomes all normal resistor failures.

These have already been supplied by the millions, are proved the world's best, are tested and approved by the P.M.G.

Write for full information on the use of IRC—PW-type resistors for original and replacement use.

INTERNATIONAL RESISTANCE CO. (A'SIA) PTY. LTD.

(A Subsidiary of International Resistance Holdings Ltd.)

Sole Australian Agents:
WM. J. McLELLAN & CO. PTY. LTD., 126 Sussex Street, Sydney. BX 1131
Victoria:
AUSTRALASIAN ENGINEERING EQUIPMENT CO. PTY. LTD., 202 Bell Street, Preston

MSA1020

nated type HJ72 is now identified as 2S142. Accordingly Hitachi listings in Table 1 often carry more than one manufacturer's type number on the same line.

"Table 1 was developed in more than one way, but a recent Japanese manual of transistor characteristics was a primary source. Since it is not always possible to find exact American equivalents for all characteristics, absolute accuracy is not claimed for the chart. Accordingly the domestic equivalents of Table 1 should be considered SIMILAR units. In all cases, however, p-n-p substitutes are given for p-n-p transistors; and, in most cases, the suggested replacement is made by the same process (drift, junction-alloy, etc.) as the original.

"To the service technician, this means that the similar unit is the starting point

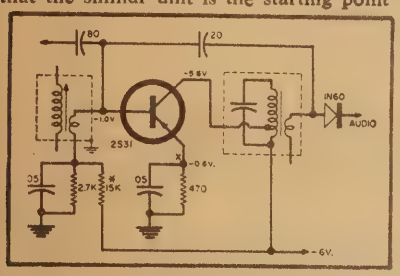


Fig. 1. A typical IF amplifier from a Japanese receiver. It is used to demonstrate the author's rule-of-thumb concerning the operating conditions of many transistor stages.

in the replacement process rather than the end itself. He must make sure that applied bias, neuralisation, and stabilisation used for the original transistor are also satisfactory for the replacement.

"The author has worked out his own techniques for checking the validity of American transistors used to replace Japanese types and making adjustments to produce the desired performance. These techniques have been tested in many radios, with uniformly excellent results.

"The first technique is predicated on the fact that most RF, converter, IF, and first-audio transistors are biased to draw approximately 1mA of emitter current. With this initial assumption, the service technician can adjust for correct rebiasing of the replacement easily.

TYPICAL CIRCUIT

"Fig. 1 shows the second IF amplifier circuit for a Toshiba Model GTR186 portable. The collector is supplied from the minus 6-volt source through part of the IF transformer primary. Junction current for the stage flows through the 470-ohm emitter resistor and returns to the positive terminal of the battery. Bias is applied to the base from a tap on a voltage divider (15,000 ohms and 2700 ohms) across the 6-volt battery.

"Since the emitter voltage (minus 0.6 volt at point X) appears across the 470-ohm resistor, it can be determined by Ohm's Law that the stage is drawing nearly 1.3mA. This is quite close to our rule-of-thumb 1mA of current given earlier.

"To see how a substitution is made, let's assume a customer brings in an unindentifiable Japanese radio, on which no service information is available, for repair. Signal substitution or tracing shows the fault is in the second IF amplifier. A voltmeter check shows the stage has collector and base voltage, but no emitter voltage. Conclusion? The IF transistor is probably open.

"To make the example specific, let us say that the defective transistor in the hypothetical receiver is identified as a type 2S31 (TEN). Table 1 gives the 2N410 as the nearest domestic equivalent. (This has wire leads, as has the original, but is otherwise the same as the plug-in 2N409.)

"Install the substitute, reduce the supply voltage to one half its normal value, and check emitter voltage. Then calculate emitter current by Ohm's Law. It should be no more than half the estimated, 1mA rule-of-thumb current, or 500 microamperes. If this current is less than expected, it means the collector is drawing less current than it did with the original transistor. It is thus safe to restore full supply voltage and again calculate emitter current.

CHECK CURRENT

"If emitter current is considerably higher than 500 microamperes, it would indicate that the wrong type of transistor (i.e., p-n-p for n-p-n) was installed or that bias is excessive. Assuming that the replacement has been carefully established to be of the same type as the original, we proceed to change the bias. This is done by adjusting the base circuit.

"The base's forward bias resistor (15,000 ohms, shown by an asterisk in Fig. 1) is removed. In this condition, emitter voltage and current drop to very small values, since the transistor draws little current without bias. A potentiometer of considerably higher value than the original bias resistor is used to replace the latter, and it is adjusted so that its full resistance is in the circuit. Adequate resistance must be used to limit base current for, if the latter is permitted to become excessive, the transistor can be destroyed.

"The potentiometer is now carefully adjusted with the voltmeter connected to point X until emitter voltage is reduced to the value at which emitter current (determined by Ohm's Law) will be 1mA. In the case of Fig. 1, for example, this would mean minus 0.47 volt at the emitter. The amount of the potentiometer's resistance that is in the base circuit is then measured, and a fixed resistor of suitable value is used instead.

"The great exception to our stated rule-of-thumb occurs in the widely used class-B push-pull output stages of transistor radios. The collectors almost always have full supply voltage applied and there is little or no emitter resistance.

"These stages are also very sensitive to the amount of applied forward bias. With too little bias, there will be considerable audio distortion. Excessive bias will drain the batteries prematurely and even destroy the transistors. Although no quicker rules-of-thumb can be followed, the following pointers will be helpful.

"Whenever a transistor in a class-B push-pull stage must be replaced, both transistors should be replaced as a pair for best results. Adjustment of forward-bias resistance can best be achieved by connecting an audio oscillator to the first audio stage and an oscilloscope at the output of the system, as shown in Fig. 2.

"Value of the bias resistor (68 ohms in this case, as indicated by asterisk) is adjusted for minimum crossover distortion. High distortion will show up in the form of the waveform labelled as incorrect in Fig. 2. Use as little resistance as possible, consistent with low distortion at adequate volume levels, determined by listening for volume while checking distortion on the scope. This will keep battery drain down. A test tone of 1000 cps is satisfactory.

"While the technique for replacing RF and IF transistors already described will work out right in most instances, there is a possible fly in the ointment, so to speak. American transistors tend to have more gain and less collector-to-base capacitance than similar Japanese types. In some cases, replacement may cause the stage to oscillate.

NEUTRALISATION

"Here's why: Our typical IF amplifier (Fig. 1) has a neutralisation circuit to cancel out the RF signal fed from the collector back to the base through the transistor's junction capacitance. This loop consists of the 20uuf capacitor between the secondary of the IF transformer and the base of the transistor. The connection is such that the signal

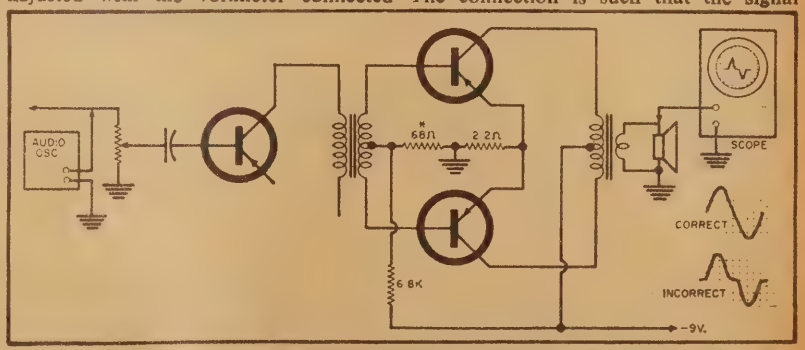


Fig. 2. The popular class B stage requires a different approach. Here bias is adjusted for minimum emitter current consistent with acceptable crossover distortion.

fed back to the base is out-of-phase with signal passed by the transistor junction. Thus, if the two signals are equal in amplitude, the capacitive feedback provides perfect cancellation and the stage is neutralised.

"Let's assume that the replacement transistor has less junction capacitance than the Japanese original. Since the amplitude of the feedback signal is greater than necessary for cancellation, the stage oscillates. If the value of the feedback capacitor is slightly off but

ELECTRONIC A&R EQUIPMENT

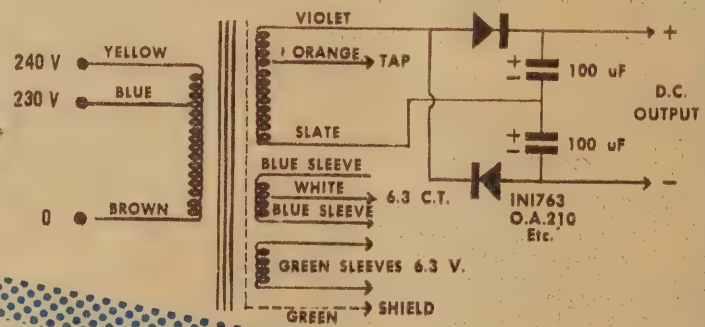
A NEW addition to the A & R Standard Range —

VOLTAGE DOUBLER TYPE POWER TRANSFORMERS

* Attractively finished in baked Silver-Grey Hammertone with Black Cores.

The use of silicon diode rectifiers, particularly in voltage doubler circuits, enables more compact equipment design with reduced heat dissipation from transformer and rectifiers.

Other advantages are improved regulation and, in most cases, reduced cost! A. & R. present the range listed below as suitable for most present-day amplifiers and similar requirements.



* All voltages given are those obtained under fully loaded conditions. Maximum temperature rise 45°C, fully loaded.

CHARACTERISTICS

TYPE No.	D.C. OUTPUT M.A.	D.C. OUTPUT VOLTS	A.C. SECONDARY VOLTS	FILAMENTS VOLTS AMPS.	EFFECTIVE R (See note*) OHMS.	WEIGHT LBS. OZS.	OVERALL HEIGHT INCHES	MOUNTING DIMENSIONS INCHES	BASE DIMENSIONS INCHES	MOUNTING TYPE
2062	80	290 285	115 TAP 105	6.3 C.T. — 2.25	25	2 2	3½	2⅛ x 2⅛	2⅞ x 3	VLN 31
2063	80	340 315	135 TAP 125	6.3 C.T. — 2.25	29	2 3	3½	2⅛ x 2⅛	2⅞ x 3	VLN 31
2064	125	340 315	135 TAP 125	6.3 C.T. — 2.25 6.3 C.T. — 2.25	18	4 15	3⅞	2½ x 2⅛	3½ x 3⅛	VLN 34
2065	150	290 285	115 TAP 105	6.3 C.T. — 6	10	5 11	3⅞	2¼ x 2⅛	3¼ x 3⅛	VLN 34
2066	190	320 285	125 TAP 105	6.3 C.T. — 6	7	6 8	3⅞	3 x 2⅛	4 x 3⅛	VLN 34

Note* — Effective Transformer Series Resistance referred to Secondary

ELECTRONIC A&R EQUIPMENT

DISTRIBUTORS

VIC:: J: H. Magrath and Co. P./L. Radio Parts P./L., Homecrafts P./L., Motor Spares Ltd., Warburton Franki Ltd., Howard Electrical and Radio Co., Douglas Radio Co. SOUTH AUST.: Gerard and Goodman, 196 Rundle St., Adelaide. QLD.: A. E. Harrold P./L., 123 Charlotte St., Brisbane, Chandler's P./L., Albert and Charlotte Sts., Brisbane, Trackson Bros. P./L., 137 Elizabeth St., Brisbane. WESTERN AUST.: Factory Rep. C. L. Sedunary & Co., 10 Melville Pde., Sth. Perth. TAS.: Homecrafts P./L., 220 Elizabeth St., Hobart. N:S:W.: Factory Reps.: R. H. Cunningham P./L., 16 Angas St., Meadowbank. Available from all Leading Sydney Distributors.

A. & R. ELECTRONIC EQUIPMENT CO. PTY. LTD. 378 St. Kilda Road, Melbourne, S.C.1. MX 1150, MX 1159

close, the problem might be even worse. Oscillation itself might not occur in the service shop, but the tendency for it would be increased. Thus, when the stage is operating at increased gain (due to a temperature change or when a weak signal reduces AVC voltage), the set might "take off."

"The unaware technician could have quite a time of it trying to figure out why a radio oscillated (or stopped working) when the customer took it on a trip but worked perfectly in the shop. In any event, neutralisation should be checked whenever RF or IF transistors are replaced with units that are not exact equivalents.

CHECKING INSTRUMENT

"The chief instrument for making this check is a small trimmer capacitor whose range extends above and below that of the original neutralising capacitor, which is used to determine the correct value needed. Bias is removed from the stage involved (as described earlier) and the radio is driven with a fairly strong, modulated RF signal from a suitable generator. The injection point is not particularly important as long as a signal can be forced through the unbiased stage under test.

"A means of measuring the signal that passes through the stage is also necessary. An oscilloscope or audio voltmeter connected between collector and ground of an output transistor works very well—but be sure to keep the volume control wide open. With this setup, replace the neutralising capacitor with the trimmer and adjust the latter while observing the output indicator for minimum signal. When this null is found, replace the trimmer with a suitable fixed capacitor (silver mica or NPO) of the correct value.

"If an instrument for measuring capacitance is not at hand, a calibrated substitution box or individual capacitors of known value could be used for the test instead of the trimmer.

"Some radios use an RC neutralising network to correct both phase and amplitude. In these, it may also be necessary to adjust the value of the resistor for proper nulling of the signal.

"In some cases, a part of the primary winding of the IF transformer is involved in the neutralising loop. Procedure here is the same as that already outlined, but the value of the neutralising capacitor is usually much smaller. The circuit is thus more critical with respect to such factors as lead length and hand capacitance.

PROBLEMS REDUCED

"With the steps outlined here, the technician can reduce most problems involving replacement of Japanese transistors to routine jobs."

I felt justified in publishing the above section of this article, not because I consider it a complete academic answer to this problem (and I don't imagine the author does either) but because I felt it was an excellent summary of the logical steps one might take in attacking jobs of this kind.

Regardless of how precise one wishes to be in regard to the final circuit adjustments and modifications, something very like what has been suggested will have to be gone through first anyway. This is aimed at getting the set going and, in most cases, functioning well enough to approach, if not equal, the original performance. However, if it is then felt that further investigation is called for, this at least provides a logical starting point.

For example, suppose we have replaced a pair of class B output transistors, made the necessary checks and adjustments as the author suggests, but find we are still somewhat short of output milliwatts. If the loss is sufficiently serious we may have to pursue the problem further, such as trying a new value of collector-to-collector load impedance.

But the point I really want to make is that we can only make these more refined adjustments after we have made the rough ones which enable us to get the system on to a working basis.

On the other hand there is a practical limit to the amount of "research" one may logically expend on such jobs. After all, any reasonably satisfactory repair is often all that the customer can fairly expect, taking into account that it is a "foreign" set, and all that this implies. The fact that it can be made to work at all may be an achievement in the circumstances, without worrying too much about marginal losses in sensitivity, power output, battery drain, etc. These are part of the price the customer must pay for the "privilege" of owning such a set.

By this I do not mean that a job should be skimped, but I do emphasise that there is a limit to the amount of time and money which can justifiably be expended on such jobs, once reasonable performance is obtained. It might be very nice to spend hours studying transistor characteristic curves (assuming one can understand 'em!) in an effort to squeeze the last microvolt or milliwatt out of such a set, but it is doubtful whether the owner will appreciate it. And he certainly won't appreciate the big fat bill which such an approach must produce.

IRONCORE TRANSFORMERS

FOR

LOW VOLTAGE

SOLDERING IRONS

TYPE No. T1/50 FOR SCOPE IRON

TYPE No. T3/56 FOR 6 VOLT IRONS

TYPE No. T3/58 FOR 12 VOLT IRONS

AVAILABLE THROUGHOUT AUSTRALIA

IRONCORE TRANSFORMERS PTY. LTD.

HIGSON LANE, MELBOURNE, C.1.

PHONE 63-4771

CHOOSE THE BEST—IT COSTS NO MORE

Resin Core SOLDERS

for reliable connections

O. T. LEMPRIERE & CO. LIMITED

Head Office: 27-41 Bowden Street, Alexandria, N.S.W.

and at Melbourne • Brisbane • Adelaide • Perth

MAKING A TRANSISTOR PORTABLE?

COMPLETE KIT OF PARTS for a TRANSISTOR SEVEN

with NEW R.F. STAGE

PRINTED CIRCUIT REDUCES HISS, INCREASES SIGNAL.

Avoid neutralising and critical layout.

£25/17/6 SET WIRED AND TESTED £2/10/- EXTRA

Complete kit of parts for the Transistor 7, including 7 Transistors, Printed Circuit Boards, Coil Kit, Rola 5F Speaker and Transformers and all necessary parts to complete this set including attractive and durable two-tone cabinet with gold trim. Fitted with special aerial coil and plug to connect to your car aerial or external aerial making it an ideal car set or for use in the country.

POSTING AND PACKING EXTRA on transistors 4 or 7 sets. N.S.W., 15/-. INTERSTATE, 22/-.

TRANSPORTA 4

Complete Kit of Parts for Transporta Four as featured in October Radio and Hobbies, including Cabinet as used with the Transporta.

£16-17-6

LESS CABINET, £14/7/6.

Most parts used in the Transporta Four can be used for the Transporta Seven should a larger set be required at a later date.

NEW 6V RECORD PLAYER £7/15/-

These new 4-speed Record Players are supplied with turnover crystal pick-up and sapphire needles, and are suitable for use with the above or any transistor radio.
Postage and packing extra.
N.S.W. 10/; Interstate 15/-.

NEW TAPE DECKS

ENGLISH TAPE DECKS, 3-SPEED PUSH BUTTON CONTROL 4 HEADS. SHOP SOILED.

£22-10-0

NEW 12in PER MAG SPEAKERS

These Standard Speakers by leading manufacturer (we cannot advertise the make) are supplied less transformer.

47/6 Packing extra. Post, N.S.W. 10/-; Interstate 12/6.

9in x 6in OVAL SPEAKERS

37/6 Post, N.S.W. 7/6; Interstate 11/6. Plus packing.

Transformers for above speakers 5,000 or 7,000 ohms, 10/-.

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp. 37/6.
Post, N.S.W. 7/6; Interstate 10/-.

Transformer for above rectifier tapped for 6 or 12 volt, with circuit for charger, 47/6
Post, N.S.W. 7/6; Interstate 10/-.

TAPE-RECORDER MOTORS

New Collaro Tape Recorder Motors, 240 volt, A.C. Adaptable for many uses. **37/6** Post extra.

CONDENSER SPECIALS

Boxes of 100 new ceramic, mica, paper and electrolytic condensers in values ranging from 50pf mica to 5 400v paper. Values include .0001, .00025, .00075, .02, .05, 1. Also 500 mfd/12v., 8 mfd/525v., 16 mfd/350v., electrolytics.

25/- per 100.
Post Extra: N.S.W., 2/6; Int., 3/6.

CONDENSER SPECIALS

100 new mica paper and ceramic condensers, mixed values.

15/- Post 2/.

NEW I.R.C. RESISTORS

I.R.C. carbon resistors, ½, 1 and 2 watt, in values 5 ohms to 5 meg., including many popular sizes. 3T, 15T, 20T, 50T, 100T, 250T, 500T, etc.
(Standard resistor colour code supplied.)

100 for 25/-. Plus 1/6 postage.

NEW METER RECTIFIERS

Westinghouse 1 mA rectifiers, 15/.

ELECTROLYTIC CONDENSERS

New Dubilier pigtail condensers,

8mfd 525v 2/9
16mfd 600V 5/9

Post Extra

TV OR AMPLIFIER POWER TRANSFORMER

240v pri., sec. 260 x 260, 250mA. 6.3 v windings.

£3/15/0 F.O.R.
(Too heavy for post.)

80 mA TRANSFORMER

240v pri., sec. 285 x 285, two 6.3v fil. windings.

32/6
Post: N.S.W., 5/; Int., 8/6.

NEW POWER TRANSFORMERS

60mA prim.: 240v with 230v tapping. Sec. 285. x 285 with 6.3v filament winding 60mA.

25/- Plus postage, N.S.W. 3/6, Int., 5/3.

NEW MIDGET POWER TRANS.

40mA prim., 250v. Sec. 225 x 225 with 6.3v Fil. Winding.

25/- 2/6 Postage, N.S.W., Interstate, 4/6.

30mA 240v Prim. 150 x. 150v. Sec. with 6.3 v Fil. Winding.

22/6 Postage: N.S.W., 2/6 Interstate, 3/6.

MICA CONDENSERS

Standard Mica Condensers, small current types .00003 and .005, including most wanted values.

10/- Postage 1/6. per 100.

CARBON RESISTORS

New carbon resistors, mixed values. Well-known make. 10/ per 100. Post free.

NEW POTENTIOMETERS

with SWITCH STANDARD SPINDLE	WITH SWITCH SHORT SPINDLE	LESS SWITCH STANDARD SPINDLE	LESS SWITCH SHORT SPINDLE
25,000 ohms	100,000 ohms.	100,000 ohms.	50,000 ohms.
100,000 ohms	500,000 ohms.	500,000 ohms.	100,000 ohms.
500,000 ohms	2/6 ea. 24/ doz.	500 ohms. 5,000 ohms.	500,000 ohms.
5/6 ea. 50/ doz.		3/6 ea. 33/- doz.	1/9 ea. 16/ doz.

25,000 ohm screwdriver adjustment, 1/9.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. Phone LM7398

SPECIAL PURCHASES!

New 5 Valve Dual - Wave Radiogram Chassis

THESE NEW DUAL WAVE RADIOGRAM CHASSIS MADE BY LEADING MANUFACTURER ARE EQUIPPED WITH LATEST MINIATURE VALVES AND SUPPLIED WITH 12in ROLA SPEAKER.

£16/15/- F.O.R.

PACKING 10/- EXTRA

NEW 4 SPEED RECORD CHANGERS

THESE NEW 4 SPEED RECORD CHANGERS ARE EQUIPPED WITH HIGH FIDELITY CRYSTAL PICK-UP AND SAPPHIRE NEEDLES. CAN ALSO BE USED AS A MANUAL PLAYER.
SUITABLE FOR USE WITH ABOVE RADIOGRAM CHASSIS.

£10/15/- F.O.R.

DUAL CONCENTRIC SWITCH POTENTIOMETERS

500,000 ohms plus 10,000 ohms, also
500,000 ohms plus 1 megohm.
Long spindle.

10/-
POST FREE.

NEW 4in PER-MAG SPEAKERS

5T or 7T Trans.

25/-
Post and Packing, 3/6.

HIGH IMPEDANCE HEADPHONES NEW 27/6

Post 2/6.

STANDARD INTERMEDIATE FREQUENCY TRANSFORMERS

455Kc. 1¼in square cans. Slug tune.
4/9 post extra.

GARRARD RECORD CHANGERS 3-SPEED 32 V.D.C.

New English Garrard Record Changers fitted with high fidelity turn-over Crystal Pick-up, Sapphire Needles. For 32-volt D.C. operation. Can be used on any D.C. voltage exceeding 32V with External Resistance.

£9/15/ F.O.R.

NEW 4-SPEED PLAYERS

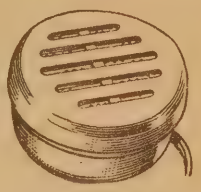
With turnover Crystal Pickup

£8 POST N.S.W., 7/6. INTERSTATE, 12/-

NEW STEREO CHANGER, 4-SPEED. F.O.R. £17/10/-

NEW 4-SPEED STEREO PLAYER £10/10/- F.O.R.

PILLO-FONE EXTENSION UNIT



IT'S A REAL MINIATURE WITH ROLA UNIT

Install it anywhere, in the sick room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED.
3½in Diameter by 1¾in deep.
POST FREE. **22/6**

Weight 13lb.
Cabinet size 13in x 10in x 6in.

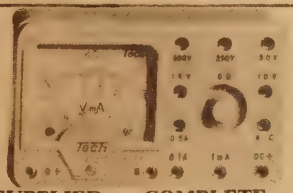
NEW-RECORD PLAYERS

Fitted with B.S.R. 4-speed Motor and Pick-up, with Sapphire Needles. In attractive and durable two-tone case.

TRANSISTORISED
Complete kit of parts, including Speaker, 4 Transistors and batteries.
£23/10/ F.O.R.

FOR 240V. A.C. OPERATION
Complete kit of parts, including Speakers and Valves.
£19. F.O.R.

Wired and Tested, 30/ extra.



SUPPLIED COMPLETE WITH TEST LEADS

NEW MULTIMETERS — 61/- POST EXTRA

METER 0-1mA 1000 OHMS PER VOLT

A.C. RANGES	D.C. RANGES	CURRENT RANGES
0—10v	0—10v	0—1MA
0—50v	0—50v	0—100MA
0—250v	0—250v	0—500MA
0—500v	0—500v	
0—1000v	0—1000v	

OHMS RANGE 0-100,000 OHMS.

NEW VALVES AT BARGAIN PRICES

6J6	12/	6K8G	6/9	1C7G	3/	6H6GT	2/6
ECH 35/VR99A. Direct replacement for 6J8G	10/	6SJ7GT	9/6	1K5G	2/6	6K7GT	7/9
1C4	7/6	12K8	10/	1M5G	3/	6U7G	5/
1T4	4/6	EK32	6/9	1K7G	3/	6J7G	5/
3S4	10/	6SA7GT	9/6	1L5	9/6	7C7	3/6
1R5	10/6	6SH7	5/6	6C8G	5/	78	7/6
1A7GT	9/6	105G	4/	6SS7	8/6	EL32	10/6
1D8GT	9/6	1P5G	2/6	6H6	2/6		
6A8G	10/6						

6B6G VR55	5/	6K7G	4/6
VR65A	2/6	1C6	7/6
41	7/6	955	2/6
7193	2/	954	2/6
12A6	7/6		
EF50	2/6		
12SH7	5/		

SPECIAL PRICES FOR QUANTITIES.
Please add postage on all valves.

NEW VALVE SOCKETS: Ceramic EF50 sockets, 2/6 ea. American moulded Loctal, 1/ ea. Octal 8-pin wafer, 6/6 doz. 5BP1 socket Ceramic, 7/6. Amphenol 5-pin ceramic, 2/6 ea. All post extra.

NEW MINIATURE COILS and I.F. TRANSFORMERS: Aerial, R.F. or Oscillator Coils, 7/6 ea. Post 1/-. I.F. Transformers, 9/6. Post 1/-. Short Wave Coils, 16 to 49 metres, 5/6 ea.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. Phone LM7398

The complete beam in position. The reflector is furthest from the camera, the dipole quite obviously in front of it, and the two directors nearest the camera. Note the spacers used to strengthen the dipole.

Simple Four Element Beam For 2 Metres

Following our description last month of a simple 2-metre transmitter, this article is intended to take the beginner one stage further towards becoming an active "Ham." It describes a simple four-element beam for the 144 Mc band, together with an ingenious beam rotating mechanism and direction indicator made from disposals equipment.

By Keith Jeffcoat (VK2BK)

SOME years ago, a two-metre antenna looked very strange. But, since the advent of television, this is no longer true. A two-metre antenna is similar, both in appearance and in electrical characteristics, to a television aerial.

This is not surprising when one considers that the two-metre band (144-148 Mc.) overlaps the television band designated Channel 5 (139-146 Mc.)

MUST ROTATE

The main difference between a TV aerial and a two-metre antenna is that, whereas the TV aerial is positioned for the best reception of signals, and then locked securely in place, the two-metre antenna must be pointed in a number of different positions to tune in various stations.

Don't be surprised, then, if a kindly neighbour drops in to tell you that your "TV aerial" has come loose and is swinging around in the breeze!

If, for some reason, we wanted to listen to only one TV channel, at a reasonable distance from the transmitter, we could make up a suitable aerial consisting of a folded dipole, with a reflector behind it and a director ahead of it.

The function of these added elements is to improve reception of the signal; in other words, to increase the "gain" of the antenna by concentrating its pick-up in one direction instead of having a broad capture area.

A similar arrangement can be used on two metres. We propose this month to give constructional details of a four-element beam designed for home station use, together with details of one method of rotating the beam and installing an indicator to tell us which way the beam is pointing.

Three and four element beams are simple compared with the very large and impressive arrays used by some of the amateur operators on the two-metre band. It is possible to construct antenna systems having as many as 13 elements on a 24-foot boom, consisting of a dipole with a reflector behind it and no fewer than 11 directors ahead of it.

Another popular method is to construct two or three beams of identical length and erect them one on top of each other.

These complicated beams are harder to construct physically, and it is also much harder to match a transmission line to them than to the small practical beams to be described here.

ADVANTAGES

The small beams have the advantage that they are easy to make, and are relatively simple to match, so that the transmitter is correctly loaded.

Being small in size, they do not need to be elaborately mounted or supported with guys, and do not overhang your neighbour's property if the highest chimney happens to be at the side of your house!

For newcomers to the two-metre band (and it is mainly for these people that the present series of articles is written) the small beams will enable you to get on the air in one Saturday afternoon, and to make your first few dozen contacts on this band.

Later on, you may want to experiment with larger and more complicated antenna systems. If so, the experience gained with the small beams will not go awry.

The four-element home-station beam described this month has been continually in use at one two-metre station in Sydney for 15 months, and the owner flatly refuses to take it down and put up a larger beam.

Larger beams are certainly "sharper" in their aperture or capture area but this tends to be a mixed blessing. The "sharp" beam pinpoints a remote station, but it also means that turning the beam a few degrees makes that same station completely inaudible.

GOOD COMPROMISE

The four-element beam is sufficiently "broad" in its capture area to pick up several stations spread over 15 degrees from the one position, yet sharp enough to pick up and put out signals with good efficiency.

DETAILS OF BEAM TURNING GEAR

Antenna systems for operation on two metres in Australia are horizontally polarised. This means that the elements in the beam are parallel to the ground. For this reason the beam should be mounted as high above the ground as possible, preferably some distance above the top of the highest chimney available.

If a tall mast can be erected, well clear of surrounding structures, and the beam mounted on top of it, so much the better.

The heart of the simple beam described this month is a folded dipole. A folded dipole consists of two dipoles, set one above the other, and joined at the ends. The feedpoint is the centre of the lower dipole.

The length of a folded dipole, at very high frequencies, is found by the formula.

$$\frac{5{,}540}{\text{freq Mc.}} = \text{equals length in inches.}$$

A little calculation shows that the length of the folded dipole at 144 Mc. will be 38.5 inches, at 145 Mc. 38.2 inches, and at 146 Mc. 38 inches exactly.

POPULAR FREQUENCIES

In the capital cities, most of the stations operating on two metres are to be found in the first one and a half megacycles of the band—between 144 Mc. and 145.5 Mc.

For mobile operation, frequencies higher up are chosen, to avoid interference from the more powerful home stations.

The reflector is made five per cent longer than the folded dipole (about 40 inches) and the first director is made five per cent shorter than the folded dipole (about 36¼ inches). Added directors are made progressively shorter.

The reflector and the directors are known as "parasitic" elements because they take power from the radiator (the folded dipole) without any direct electrical connection, and re-radiate this power as required.

If a parasitic element is made slightly longer than the radiator, it will re-radiate the power it has absorbed back towards the folded dipole. This is why we call it a "reflector." It is like a mirror placed behind the dipole.

If a parasitic element is made slightly shorter than the folded dipole, it will re-radiate in a forward direction. (Hence its title of "director." It is like a lens placed ahead of the dipole.)

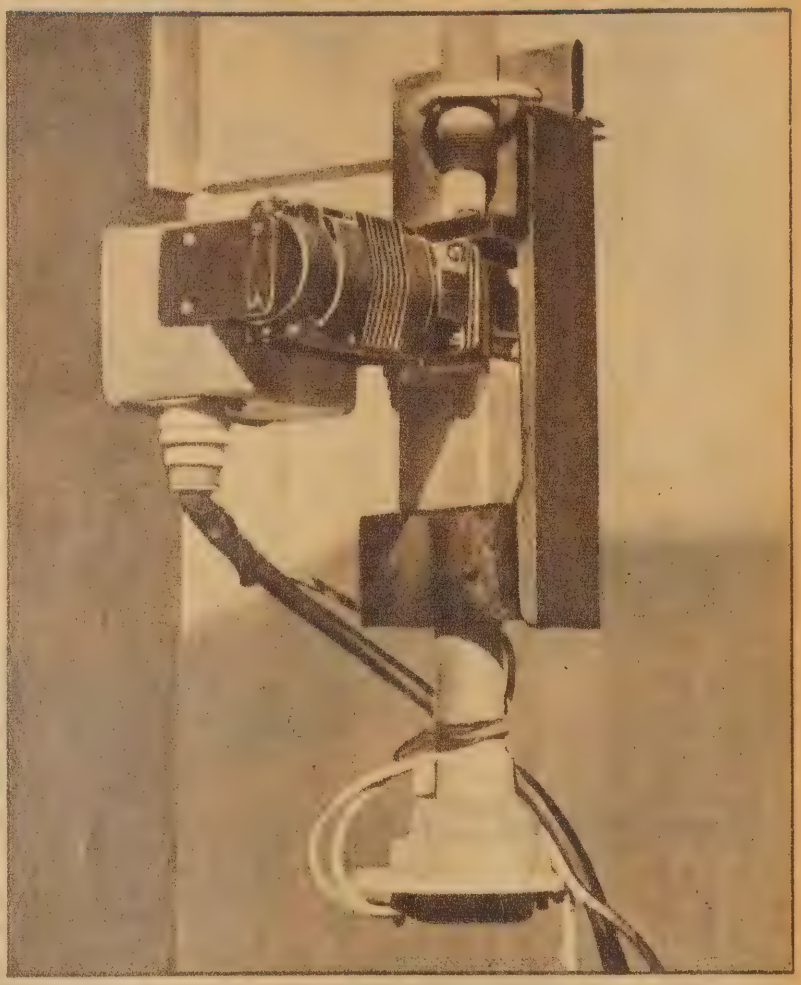
FORWARD RADIATION

Without going into the text-books, we can see that the combined effect of the reflector and director is to reinforce the wave radiated outward from the folded dipole and concentrate it in a forward direction.

The amount of additional forward gain is determined to some extent by the spacings between the folded dipole, the reflector, and the director.

The spacing of the parasitic elements also affects the radiation resistance (or impedance) of the folded dipole, close spacing of the elements reducing the impedance at the centre of the folded dipole, wider spacing increasing the impedance.

In making our beams, we shall have to consider both of these factors, firstly the impedance to be achieved at the centre of the folded dipole (the feed point of the whole antenna system), and secondly the amount of forward gain to be attained.



A close up of the beam rotating motor fitted to the bottom of the supporting mast. At the extreme lower end is the fuel gauge mechanism which forms part of the direction indicator system. The indicator proper is shown on page 58.

With small beams—those containing up to five elements—the spacing most often used between the elements is .2 of a wavelength (16 inches).

Let us look first at the question of impedance. The impedance at the centre of an ordinary half-wave dipole is 75 ohms. By placing a second dipole underneath it, connected at the ends, we increase the inductance of the radiator, and the impedance of two parallel dipoles of equal cross sectional area is multiplied four times to 300 ohms.

POSSIBLE IMPEDANCES

We could make a correct match by using 300 ohm TV ribbon for our feedline but, since the addition of the reflector and the director is going to upset the impedance anyway, we may as well space them to bring the impedance back to 75 ohms. We can then feed the antenna with 75 ohm coaxial cable.

To make the beam, take a length of three-quarter-inch dural tubing 42 inches long. This will be the boom. From one end drill a quarter-inch hole at a distance of one inch, then three more at intervals of 16 inches. The elements are cut from quarter-inch dural tubing. The reflector is 40 inches long, the first director 36¼ inches long, and the second director 36 inches long.

THE DIPOLE

The folded dipole is 38¼ inches long, with the parallel dipoles one and a half inches apart, centre to centre. To make this, take a length of dural tubing measuring 78¼ inches, and slide it through the boom, bolting it exactly in the centre.

Before bending up the arms, make two perspex pieces two and a half inches long by one and a half inches wide, with quarter-inch holes drilled near each end, the spacing between these holes being one and a half inches centre to centre.

JUST RELEASED . . . for Stereo or Mono!

BSR RP4A

4-speed STEREO or MONO RECORD PLAYER

Brilliant Performance plus outstanding Economy — with new features, new styling, new compactness.

Here's the player you've been waiting for . . . beautifully-styled, designed and quality built in Australia for Australian conditions. Backed by world-wide B.S.R. experience, it brings you superb performance at lowest cost. Ideal both for home installations or portable equipment. Just read the feature list!

ONLY £11 for monophonic. (convertible to stereo)

ONLY £13/5/- Stereo and mono combination

Available now from leading radio houses.

Sole Australian Distributors —

GOLDRING ENGINEERING (AUST.) PTY. LTD.

449 Kent Street, Sydney. Phone BX 1275/6.

The features you want, at the price you want to pay!

New recessed turntable design, beautifully finished in gold, cream and brown. High torque two-pole 240 volt 50 c/s induction motor with special rotor balanced electronically to very fine tolerances. Vibration-free — rumble, wow and flutter at absolute minimum. Four speeds, 16.2/3, 33.1/3, 45 and 78 r.p.m. Modern style pick-up arm with finger lift. "Pull-to-right" start. Sensitive B.S.R. automatic stop. Automatic device eliminates flat spots on pulley. Turnover-type cartridge for Stereo, L.P. and 78. Supplied with two sapphire styli . . . 0.0007" radius for Stereo and L.P., 0.0025" radius for 78. Diamond 0.0007" stylus available as optional extra. Spring mounted unit plate. New improved rubber turntable mat.

Slip one of these spacing pieces over each end of the dural tubing and push them in to the centre.

Next, start to bend each side of the tubing at a distance of about 18 inches from the centre, so that the furthest point of the one and a half inch bend is 19⅛ inches from the centre.

Having bent both sides of the dipole, slip the ends through the perspex spacing pieces, and slide them out until they are about 10 inches from the centre. They will hold the two dipoles parallel.

At the centre, run a one-eighth bolt through the boom. Attach a three-lug tagstrip to the bottom of this before tightening on the nut with a spring washer. Each end of the dipole is then flattened and bolted to an outer lug of the tagstrip. The coaxial cable may be soldered to these lugs.

TV FITTINGS

The four-element beam is locked to a 12-foot vertical shaft by means of a standard TV aerial U-clamp. The vertical shaft rides inside a length of 7/8th inch pipe, attached to the chimney with a standard TV aerial chimney fitting.

A collar of 7/8th tube bolted to the support shaft stops it slipping completely down the pipe.

With this beam, the elements are all 16 inches apart, centre to centre. This spacing is necessary to make the impedance at the centre of the folded dipole 75 ohms.

An important point now arises. Each of these beams must be fed with a balanced line, but coaxial cable does not make a balanced line.

We could use 300 ohm TV ribbon for our feedline. This is a balanced line, but it would mean installing an aerial matching unit between the feedline and the output of the transmitter.

A more practical method is to couple directly from the transmitter with a length of 75 ohm coaxial cable, and correct the unbalanced-to-balanced condition at the antenna end of the line with a 1:1 matching balun. There are two ways of doing this.

One method — used with the three-element beam — is to place a metal sleeve one-quarter of a wavelength long over the feedline at the end nearest the antenna, with the bottom end of the sleeve connected to the outer braiding of the coaxial cable. Since the vertical support shaft is hollow, we have a ready-made sleeve.

BALUN DETAILS

All that is necessary is to drill a hole half an inch from the top of the shaft and a second hole 16 inches lower down. The coaxial feedline is pushed through the lower hole, passed up the shaft, drawn out through the top hole, and connected to the dipole. At the point where the cable enters the lower hole, the insulation is carefully removed and an electrical connection made between the braid and the pipe with tightly wound copper wire.

On paper, it would appear that the holes should be 19¼ inches apart, but in practice correct matching was achieved with the shorter length. (So-called "quarter-wave" matching sections generally work out to be less than a quarter-wave calculated in free space.)

The second method of making a matching balun is the one actually used for this particular beam. In this case a length of coaxial cable 16¼in long is hung from the beam beside the feedline, spaced ¼in out from it. The centre wire of the balun is not connected at either end, but its outer braid is connected to the centre of the feedline at the top, and to the braid of the feedline at the bottom.

Either of these baluns can be used. We'll spare you the mathematics; in practice, they work.

The forward gain of the three-element beam is 7.8 db over a single dipole, a power increase of about six times. The forward gain of the four-element beam is approximately 8.5 db, a power increase of about seven times over a single dipole.

A practical test on the back-to-front ratio of the beam showed that a maximum signal received on the front of the beam was heard at half-strength when the beam was rotated 180 degrees, and could not be heard at all with the beam broadside on to the signal source.

ROTATING THE BEAM

For this reason, it is necessary to have some method of turning the two-metre antenna to pick up transmissions from, and to transmit to, stations situated at various points north, south, east and west of your own location.

With a mobile beam, this presents no problems: one simply reaches out, grasps the vertical support shaft, and turns the beam by hand until the incoming signal in the receiver is loudest. This is called "peaking" the beam.

With a home station beam, however, turning by hand is generally out of the question. The beam should be as high above the roof as possible, preferably several feet above the highest chimney.

If by some happy chance, this chimney is at the side of the building, then it is possible that the vertical support shaft of the beam may extend down the side of the house to some point outside the window of the room in which you are operating. In this case, a handle may be fitted to the base of the shaft, and the beam may be turned by hand.

INCONVENIENT

The disadvantages of this system, however, are that one must move from the operating desk over to the window whenever one is tuning around, in order to peak the beam; and not only that, it also means that one must open the window and expose oneself to the weather every time the beam has to be turned.

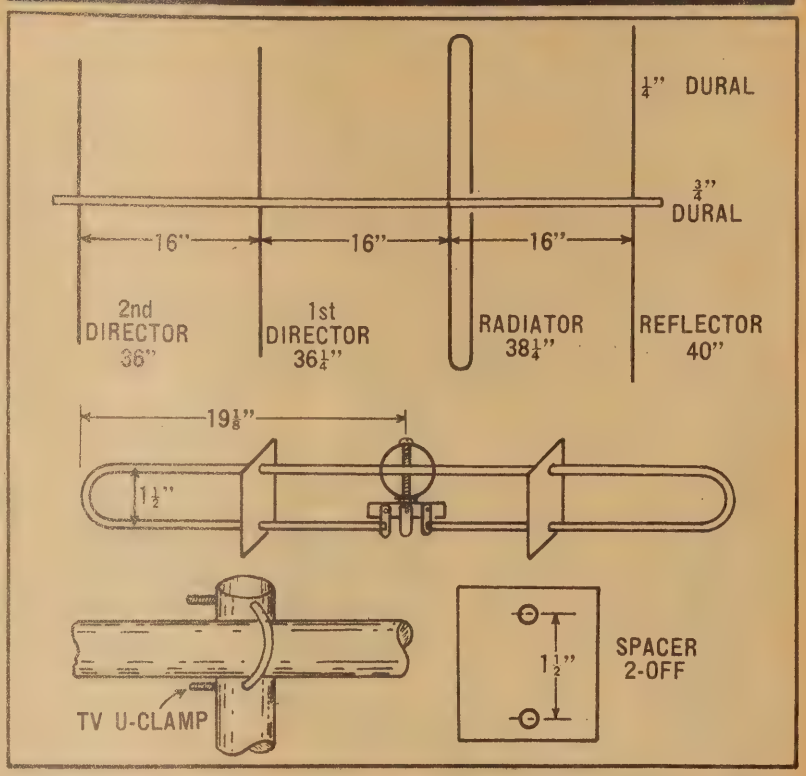
It is a much better idea to have the beam turned by a motor, which can be remotely operated from the operating room. There are a number of small motors available, both commercially and from disposals sources, which will do the job.

Ideally, the motor should have reversing facilities, so that the beam can be turned first in one direction, and then turned back in the other direction. This will prevent the feedline from being wound around the vertical support shaft.

The four-element beam described here is rotated by means of a small motor obtained from a disposals store. It is a Lear-Avia motor, originally used to raise and lower the wing flaps of an aircraft. It is designed to operate on 24 volts DC but works quite well on 12 volts DC.

The motor has two field coils, and is

BEAM DIMENSIONS & FITTINGS



Constructional details and essential dimensions of the four-element beam. Although dural tubing is used because of its mechanical advantages, it is not essential, and identical performance will be obtained using brass or other tubing.

ACCLAIMED BY THE EXPERTS . . .

ROLA

Professional

MODEL 77

TAPE RECORDER

In every major Broadcast Network, TV Station and Recording Studio throughout Australia the Rola Professional Model 77 recorder is regarded by recording engineers as the finest equipment of its type which money can buy.

Over the years the "77" has built up a reputation for superlative electronic and mechanical performance coupled with unrivalled reliability of operation.

The Rola Professional Model 77 is designed to provide

- SIMULTANEOUS REPLAY MONITORING.
- DIRECT COMPARISON OF ORIGINAL AND RECORDED SIGNALS AT ANY SPEAKER VOLUME BY MEANS OF AN A-B CONTROL.
- METER AND LINE SWITCHING TO EITHER RECORD OR PLAY CHANNELS.
- INDEPENDENT CONTROL OF MAIN RECORD AND PLAY AMPLIFIERS.
- SWITCHING FROM PLAY TO RECORD WITHOUT ANY PAUSE IN TAPE MOTION AND WITHOUT ANY CLICKS OR ELECTRICAL THUMPS BEING HEARD OR RECORDED.

These features and its adherence to CCIR specifications make the Rola Professional Model 77 a recorder which will duplicate and even improve upon the facilities available in some of the most complex and expensive console-type machines.

ROLA COMPANY (AUST.) PTY. LTD.

THE BOULEVARD, RICHMOND, E.1, VICTORIA. JB 3921
CALTEX HOUSE, KENT ST., SYDNEY, N.S.W. BU 6147

fitted with cut-off switches activated by two cams. Passing a current through one field winding causes the motor to rotate the drive shaft clockwise until a switch breaks the current.

Passing current through the other field winding causes the shaft to rotate counter-clockwise until the second switch is operated.

The motor is coupled to the gearbox and then to the drive shaft by means of a magnetic clutch which comes into operation as soon as it is energised, and which stops immediately the current is interrupted. All that is needed in the operating room are two buttons, to make the beam turn slowly clockwise, stop, and then track back counter-clockwise.

CUT-OFF SWITCHES

The cams which close the two switches inside the motor housing may be adjusted to cut-off at any point. We adjusted ours to give us 350 degrees turn. The missing 10 degrees fall between the Heads of Sydney Harbour—a "no signal" area unless a ship equipped with two-metre transmitting gear is approaching.

The Lear-Avia motor has two drive shafts, one on top, the other below, the housing. The vertical shaft of the four element beam fits snugly over the top shaft, which turns the beams through 350 degrees in exactly 40 seconds. This is fast enough to make a quick scan of the surrounding stations, yet slow enough to cause the "S" meter on the receiver to give a healthy kick if a signal is picked up.

The lower shaft can be used to drive some kind of indicator which shows in what direction the beam is pointing at any time.

For this task, two pieces of ex-service equipment were pressed into service. One is a potentiometer which formed part of an aircraft fuel tank level gauge (identification number G6A/3340), the other a remote-operating compass indicator (type number AF 42).

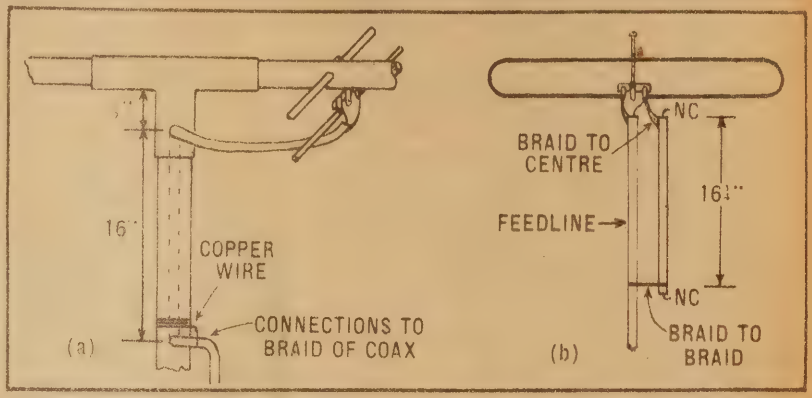
The potentiometer is fitted inside a metal tube, and its moving arm turned by a cogwheel attached to a metal strut and a wooden float.

In its original operation, the falling or raising of the level of fuel in the aircraft's tanks would rotate the moving arm of the potentiometer. The voltage drop across the potentiometer would cause a degree of meter deflection in the "fuel level indicator" on the aircraft's instrument panel.

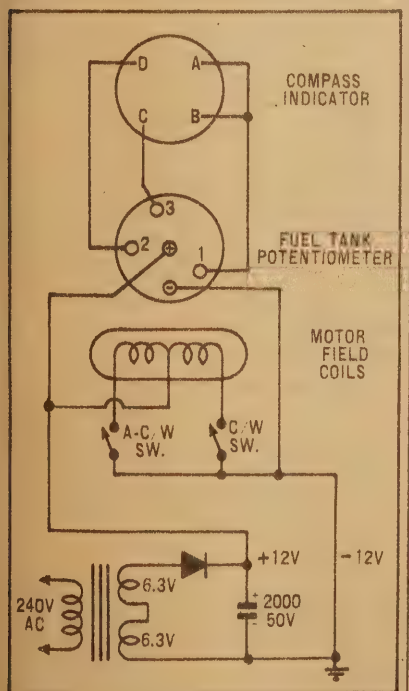
With the wooden float and the metal strut removed, the cogwheel turning the moving arm of the potentiometer fits inside the lower drive shaft of the motor. As the beam turns, the moving arm of the potentiometer turns with it, causing a variation in voltage drop.

The resultant voltage is applied to the terminals of a Magnesyn remote-operating indicating compass. The dial of this meter is marked with the four points of the compass, and calibrated through 360 degrees. Designed originally to operate on 26 volts at 400 cycles, the compass indicator works very well indeed from our 12 volt DC source.

Since there are five connections to the fuel-tank potentiometer (three connections to the pot. itself, and a positive



Details of the two matching baluns described in the text. The one shown at (a) is a convenient one for mobile beams, while the one shown at (b) is the one used for the beam described here.



Circuit showing connections for the beam rotating and indicating mechanism. Power is derived from a 12 volt transformer winding and a metal rectifier.

Pantechna Pty. Ltd. are extremely proud to introduce from the U.S.A. the entirely new

EMPIRE and GRADO

STEREO CARTRIDGES AND TONE ARMS

Recognised by leading experts as the finest in their field. Both these remarkable cartridges have the extremely low stylus mass of only 0.7 to 0.8 milligrams, not achieved by others and so essential for transparency, naturalness and avoidance of false coloration. No groove wear or needle talk because of such low dynamic mass — hence their superiority.

Both Tone Arms achieve complete dynamic balance at any angle — even upside down. It will be a revelation even to untrained ears when using above cartridges in these gyro-balanced arms as all the fizz in recorded strings disappears, leaving a rich, warm quality typical of massed strings. Hi-Fi enthusiasts will gladly discard other systems for the benefit of such additional qualities.

EMPIRE "88" Stereo Cartridge with Diamond Stylus. Incorporating the moving magnet principle brought to the highest stage of development. Frequency response 20-20,000 cycles plus or minus 2 db. Hum Pickup eliminated. Outstanding stereo channel separation. Both channels balanced plus or minus 1 db. Compliance vertically and laterally 5 micro-cm./dyne. Stylus easily replaced. Fits standard tone arms. Tracking pressure 2-3 grams.

EMPIRE "98" Stereo/Balance Transcription Arm. See above.

GRADO "Master" Stereo Cartridge with Diamond Stylus. A moving coil cartridge of supreme quality for the most critical listener. Each unit is custom-fitted and assembled to almost unbelievable tolerances. Frequency response 10-30,000 cycles. Both channels balanced plus or minus ½ db. Outstanding channel separation. Compliance vertically and laterally 8 micro cm./dyne. Fits standard tone arms. Tracking pressure 2-3 grams.

GRADO Micro-Balance Tone Arm. See above.

Sole Australian Agents:

PANTECHNA PTY. LTD. 6a Elizabeth Street, Melbourne C1.

Phone MF 8811

Distributors for N.S.W.: AUDIO ENGINEERS PTY. LTD., 422-4 Kent St., Sydney

Equipment for the Home & Professional

Tape Recordist

AMERICAN "IRISH" RECORDING TAPE

Green Band Type 211 (Acetate Base), 600ft—5in reel .. £1 12 6
Green Band Type 211 (Acetate Base), 1,200ft—7in reel .. £2 11 0
Long Play Type 601 (Mylar Base), 900ft—5in reel .. £2 7 1
Long Play Type 601 (Mylar Base), 1,200ft—7in reel .. £3 9 0
Double Play Type 724 (Tensilised Mylar), 1,200ft—5in reel .. £3 18 10
Double Play Type 724 (Tensilised Mylar), 2,400ft—7in reel .. £6 13 0

BASF MAGNETOPHONBAND RECORDING TAPE

Standard — LGS 52 400ft 4¼in reel .. £1 5 6
" — LGS 52 600ft 5in reel .. £1 14 9
" — LGS 52 900ft 5¾in reel .. £2 5 6
" — LGS 52 1200ft 7in reel .. £2 18 3
" — LGS 52 2400ft 10½in reel NAB Spool or Hub. Prices on Application.
Long Play — LGS 35 210ft 3in reel .. 15 6
" " — LGS 35 600ft 4¼in reel .. £1 13 0
" " — LGS 35 900ft 5in reel .. £2 4 0
" " — LGS 35 1200ft 5¾in reel .. £2 16 6
" " — LGS 35 1800ft 7in reel .. £3 17 3
Double Play — LGS 26 300ft 3in reel .. £1 6 0
" " — LGS 26 1200ft 5in reel .. £3 13 9
" " — LGS 26 1800ft 5¾in reel .. £4 18 6
" " — LGS 26 2400ft 7in reel .. £6 4 0

MISCELLANEOUS ACCESSORY TAPES

BASF Leader Tape. Length 50 metres. Green, Red. Yellow or white .. 16/3
BASF Metallic Switch Tape for Auto-Stops. 25 metres .. £1/1/6
BASF ALIGNMENT and FREQUENCY TEST TAPE, 3¾ or 7½in/sec, recorded to C.C.I.R. Curve. NETT £15/9/6
BASF Splicing Tape ¼in x 33ft .. 7/-
BASF Splicing Tape ½in x 33ft .. 9/3

TAPE SPARES AND ACCESSORIES

Plastic Spools in Boxes No. 8 3in .. 6/3
" " " " No. 11 4¼in .. 8/9
" " " " No. 13 5in .. 12/-
" " " " No. 15 5¾in .. 13/6
" " " " No. 18 7in .. 14/6
Anti-Magnetic Scissors .. NETT £5/1/3
BYER Recorder Head De-Magnetisers .. £3/5/6
SCOTCH Dispenser "Write-On-Labels" for tape and tape box identification; ¾in x 100in reel. Type No. 48-¾S .. £3/4/-
BYER Pressure Sensitive Idenfitication Labels. Pkt. 30 .. 4/6
BYER Tape Splicers .. £1/1/6

SCOTCH RECORDING TAPE

Scotch No. 111A (Acetate Base) 200ft 3¼in reel .. 17 6
" No. 111A (" ") 600ft 5in reel .. £1 18 0
" No. 111A (" ") 850ft 5¾in reel .. £2 7 0
" No. 111A (" ") 1200ft 7in reel .. £2 18 6
" No. 111V (P.V.C. ") 200ft 3¼in reel .. 18 6
" No. 111V (" ") 600ft 5in reel .. £1 19 0
" No. 111V (" ") 850ft 5¾in reel .. £2 11 0
" No. 111V (" ") 1200ft 7in reel .. £3 3 0
" No. 150 (Polyester Mylar) 300ft 3¼in reel .. £1 8 0
" No. 150 (" ") 900ft 5in reel .. £3 10 0
" No. 150 (" ") 1275ft 5¾in reel .. £4 4 0
" No. 150 (" ") 1800ft 7in reel .. £5 10 0
SCOTCH Leader and Timing Tape, ¼in x 150ft .. 14 0

AMERICAN "AUDIOTAPE" RECORDING TAPE

Double Play on ½ mil "Mylar" polyester film, 2400ft 7in reel .. £7/10/
Standard Play on 1½ mil "Mylar" polyester film, 1800ft 7in reel.

JAPANESE TYPE TDK "SYNCHROTAPE"

Cat. No. PL2 Standard 62 Metres, 3in reel .. 11 4
Cat. No. AC3 Long Play 93 Metres, 3in reel .. 13 4
Cat. No. PL6 Standard 185 Metres, 5in reel .. £1 9 6
Cat. No. AC9 Long Play 227 Metres, 5in reel .. £1 19 9
Cat. No. PL12 Standard 370 Metres, 7in reel .. £2 15 0
Cat. No. AC18 Long Play 555 Metres, 7in reel .. £3 14 3

ARE YOU DISSATISFIED WITH YOUR RECORDINGS? NINE TIMES OUT OF TEN YOU'RE NOT USING THE RIGHT MICROPHONE FOR THE JOB! HERE IS THE PICK OF THE MICROPHONE MARKET. WRITE TO US WITH YOUR PROBLEM — MAYBE WE CAN HELP YOU.

MICROPHONES FOR EVERY PURPOSE

B. and O. (Scandinavian) Ribbon: Talk-Music-Off switch; inbuilt Hi-Med-Low Impedance adjusting Switch; Broadcast Quality .. £42/7/9
GELOSO (Italian) Double Ribbon. Inbuilt ON-OFF Switch; Impedance 200 ohms (or high Impedance when used with TL250GR Line-to-Grid Transformer); Broadcast Quality. Model M416 £15/15/
MD21 SENNHEINSER (German) Dynamic Microphone; 200 ohm impedance straight off the moving coil; Broadcast Quality .. £23/3/9
55RD ZEPHYR (Australian) Cardioid Microphone; High Impedance or low Impedance (50 ohms). Can compare with any microphone in the under £100 class; Broadcast Quality .. £44/2/10
TM7 NEAT (Japanese) Dynamic Microphone. Pencil Type, available high and low Impedance. Excellent response to 10 Kc/s; Inbuilt ON/OFF switch. Complete with table stand .. £10/2/
TM10 NEAT (Japanese) Dynamic Microphone. Pencil Type, available high and low Impedance. Excellent response to 10 Kc/s. Complete with table stand .. £7/15/9
RBH RESLO (British) Ribbon Microphone. High or Low Impedance by use of appropriate connecting cable. Suitable for close talking by use of easily fitted damping pads .. £23/10/6
DPH RESLO (British) Dynamic Microphone. High or low Impedance by use of appropriate connecting cable .. £22
DP4 GRAMPIAN (British) Dynamic. Excellent high frequency response. Available in high or low Impedance. Complete with table stand .. £20/3/

LOW-IMPEDANCE-TO-GRID BROADCAST QUALITY MICROPHONE TRANSFORMERS

SENNHEINSER (German) 200 ohm 30:1 transformers 20-20,000 c.p.s Triple Screened, Mumetal case and core. Type TB421 .. £5/15/6
WODEN (British) 50 ohm 30:1 transformer 20-15,000 c.p.s. Triple Screened, Mu-metal case and core. Type MT101 .. £3/14/6
HAUFE (German) 200 ohm 20-1 transformers 20-20,000 c.p.s. Primary C. Tapped; 50 c.p.s. 0.7 db; 15 Kcs-0.8 db. Broadcast and Tclevision quality. Type T119A .. £4/1/3
HAUFE (German) Super Qualjty with symmetrical centre-tap and electrostatic shield; 200 ohm 30:1 with frequency response 20-20.000 c.p.s.; 50 c.p.s.-0.3 db; 15 Kcs-0 db. Type T30/30. £7/3/3
HAUFE (German) Super Quality. Similar characteristics to Type T30/30 (above) but 45:1 ratio. at 50 c.p.s.-0.4 db; 15 Kc/s-0.6db. Type T30/45 .. £8/1/4

Trade discounts apply to professional recordists, amateur, broadcast and television stations, religious, educational and technical institutions of all types, Government departments and manufacturers. Please write for details.

WILLIAM WILLIS & CO. PTY. LTD.

THE HOUSE OF QUALITY ELECTRONIC PRODUCTS

428 Bourke Street, Melbourne, C.1.

Telephone: MU2426

and negative return) and three connections to be made to the motor (a positive supply and two negative returns, one through each of the two push-buttons), it is necessary to run seven wires out to the beam-rotating assembly. (The positive wire is common to both motor and pot.)

The motor and fuel-tank unit are bolted to the TV-clamp holding the pipe in which sits the vertical shaft support for the two-metre beam. The method of assembly can be clearly seen in the accompanying photograph, and the wiring diagram for the motor, potentiometer and compass indicator, is also given.

The controls and indicator for the beam mechanism. The two buttons initiate beam movement, clockwise and anti-clockwise respectively, while the meter above shows the direction in which the beam is pointing.

To operate the beam-turning motor and the indicator, 12 volts DC is necessary. This can be obtained by connecting two 6.3 volts AC windings in series, and rectifying this voltage with a metal rectifier capable of carrying 12 volts at 5 amps. A 2,000 mfd 50V condenser is wired in as a filter. (A bridge rectifier circuit can be used here, if desired.)

We repeat again that it is possible to build much larger beams than the small one described here, with correspondingly greater increases in gain. But this beam will definitely get you "on the air" with minimum trouble—a worthwhile first step into the joys and sorrows of two-metre work.

MORE NEXT MONTH

Next month we hope to take readers one stage further in the realm of 144 Mc, with a description of a three-element beam for mobile work. This follows the same general principles on which the present beam is based, but different element spacing is used to preserve correct impedance with one less element.

In addition, it employs an ingenious method of mounting, enabling this to be done without drilling any holes in the car, and with virtually no risk of damaging the finish in any way. Another advantage is that it may be fitted or removed in a few seconds.

So, if you have ideas about "going mobile" but just haven't found time so far to work out a suitable beam, we suggest you watch out for next month's article. It should enable you to get going with a minimum of time and trouble.

RESEARCH GRANT TO NEW ENGLAND UNIVERSITY

DR R. B. MADGWICK, Vice-Chancellor of the University of New England, announced in Armidale recently that the university has concluded a contract involving 320,000 dollars with the Air Force Research Division, Cambridge Research Laboratories at Laurence G. Hanscomb Field, Bedford, Massachusetts. The contract will finance a two-year research project to be directed by Dr R. A. Smith of the Physics Department of the University. The action of powerful beams of gyrowaves on the lower regions of the ionosphere will be investigated.

LARGE PROJECT

Dr Madgwick commented that this is one of the biggest research contracts undertaken in Australia and supported by the U.S. Government. He said that the Physics Department of the University has already produced research of high quality in this and other fields which has brought credit to the staff itself and to the university. The contract now concluded will not only extend research in Physics but will provide a very marked stimulus to research throughout the university as a whole.

Dr Smith and his colleagues at the University of New England and Professor V. A. Bailey of the University of Sydney commenced in 1947 a joint research project of research into gyrowave interaction. These researches, which used much less powerful beams than are now contemplated, verified Professor Bailey's theory of the gyro-interaction of radio waves which he published in 1937 and 1938. The research now to be undertaken and supported by the Cambridge Air Force Centre, is based upon a theory of the action of very powerful beams of waves published in 1959 by Professor Bailey, who will be closely associated with the new project.

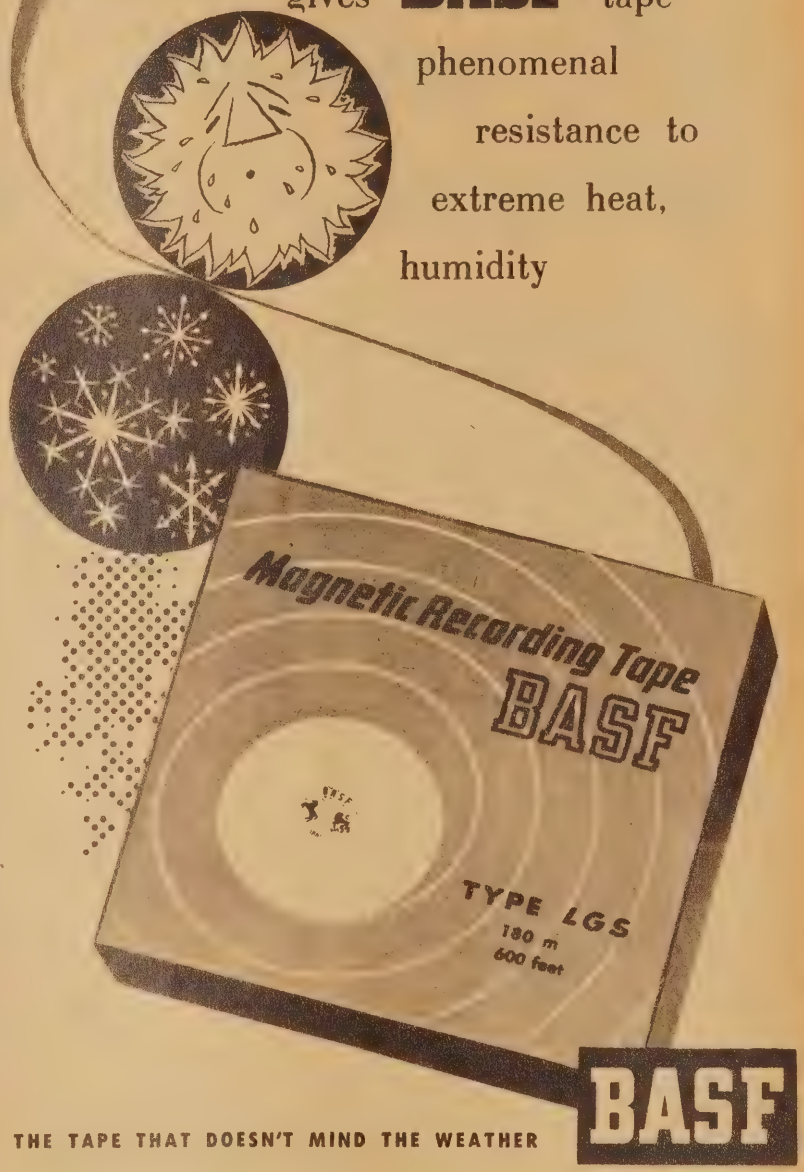
POWERFUL TRANSMITTER

The contract will finance the construction and erection of a transmitter of 500 kw power and an associated array of 40 aerials which will cover an area 600 yards x 600 yards. The aerials will be erected on land near the university. When completed in July, 1961, the transmitter will be the most powerful one in Australia.

Dr Smith explained that the ionosphere is a region of the upper atmosphere which can reflect radio waves because it contains free electrons which make it conducting. A gyrowave is a radio wave whose frequency is close to that with which the electrons in the ionosphere gyrate about the earth's magnetic field. The array will radiate upwards a concentrated beam which will greatly heat up the electrons in the ionosphere 55 miles above Armidale and, as a result, will profoundly alter the capacity of this region of the ionosphere to reflect radio waves. With this system, it will be possible to make many fundamental studies of the properties of free electrons in air under conditions that cannot be duplicated in the laboratory.

Exclusive LUVITHERM P.V.C. Base

gives **BASF** tape phenomenal resistance to extreme heat, humidity



THE TAPE THAT DOESN'T MIND THE WEATHER

Use BASF tape *anywhere*. Its mirror finish records and plays *perfectly* in searing heat to 122°F., with up to 100% relative humidity, and in arctic conditions to —58°F. It is extremely flexible and non-inflammable. Don't gamble with Acetate based tapes, insist on BASF with the time proven P.V.C. Luvitherm base.

Write to have your name placed on the mailing list for the BASF Quarterly News Magazine. It's *free* and full of tips to tape users.

World famous BASF Magnetic Recording Tape is now available in these sizes:

TYPE	RETAIL
STANDARD—LGS 52	
450' x 4½"	25 6
600' x 5"	34 9
900' x 5¾"	45 6
1,200' x 7"	58 3
LONG PLAY—LGS 35	
210' x 3"	15 6
600' x 4¾"	33 0
900' x 5"	44 0
1,200' x 5¾"	56 6
1,800' x 7"	77 3
DOUBLE PLAY—LGS 26	
300' x 3"	1 6 0
1,200' x 5"	3 13 9
1,800' x 5¾"	4 18 6
2,400' x 7"	6 4 0

AUSTRALIAN DISTRIBUTORS:

Maurice Chapman & Co. Pty. Ltd.

158 CLARENCE STREET, SYDNEY. BX 5127

Available at all good trade and retail outlets

G849

Here's your answer, Tom!

As promised in the last issue, we are continuing this month the discussion of electronic fundamentals. Magnetic effects are considered, and the relation between electric currents and mechanical forces explained. Self-inductance of a circuit is explained by Lenz's Law.

By Jamieson Rowe

BEFORE we think about electric currents and their relationship with magnetic effects, let us consider what we understand by the words "magnetism" and "magnetic fields."

The first generally accepted observance of magnetism and magnetic effects was in connection with Magnetite, an ore of iron. Lumps of this ore were found to attract iron objects.

Later on it was discovered that a lump of magnetite, if freely suspended by a string, oriented itself in a fixed position in space. Long thin lumps of magnetite were found to point in an approximate North-South direction, in such a way that one end of the lump always pointed North, and the other end South. These lumps were used as aids to navigation, and were called "lodestones" (leading-stones).

POLES

The end of a lodestone which consistently pointed in a Northerly direction was called the North-seeking or North "pole," while the other end was called the South pole.

Two lodestones freely suspended near one another were found to interact, similar poles of each being mutually repulsive, while dissimilar poles were found to be mutually attractive.

For example, the two lodestones would never freely rest in a position where their two North or South poles were adjacent to one another, but would always swing around so that the North pole of one was adjacent to the South pole of the other.

Thus was born the old adage of schoolday Physics — "Like poles repel, unlike poles attract."

It was also found that a lump of iron which had been rubbed with a lodestone acted in a similar fashion to a lodestone. Thus the name "magnet" was coined, meaning any object which acted like a lodestone, or an actual lodestone itself.

COMPASS EXPLAINED

From the reaction between two suspended lodestones (or magnets), the behaviour of a single magnet when freely suspended could be explained; the Earth was itself a giant magnet and a suspended magnet merely moved so that it satisfied the old "like poles repel . . ." law.

You may well ask—"If this is the case, then the actual North geographic pole must be a magnetic "South" pole, because the North pole of the magnet points North." This is quite true and the confusion arises because the name of "North-seeking pole" was shortened to "North pole." In practice it causes little trouble, so no attempt to rectify matters has been made.

When a small, freely suspended magnet (or compass) is moved around a fixed magnet, it points in a direction which varies considerably with its position. By "pointing," we mean that it orientates itself in a definite position, with the North end consistently on the same side.

Figure 1 is an attempt to illustrate this phenomenon. The little circles with arrows represent the compass in different positions, the arrow head representing the North pole of the compass magnet. The dotted lines represent what happens if we move the compass in the direction in which it points.

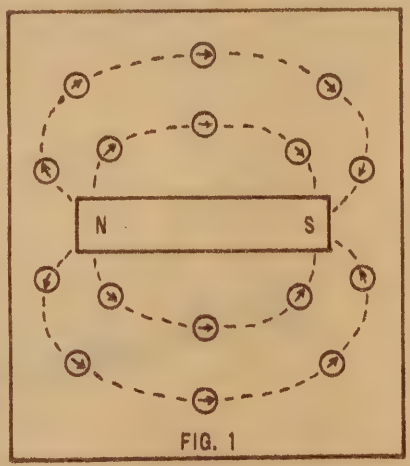


FIG. 1

Fig. 1. A small compass can be used to observe the magnetic force field surrounding a magnet.

Obviously, we can draw any number of these paths, according to where we put the compass in starting. Thus is born the idea of the magnetic force field, the lines merely showing what happens at various parts of the field to a compass.

Another way of imagining it is to say that the lines represent typical paths of a "free" North pole if it were put into the field. As you can see, arrows on the lines show that they go from the North pole of the magnet to its South pole, as this is what a "free" North pole would do.

Actually, the present theory of magnetism denies that a single North or South pole could exist, so the idea of a "free" pole is merely used to help understand the field concept.

If we accept the idea of the lines of force representing the path taken by a "free" North pole, it follows that the lines show the direction of the magnetic force field at typical parts of the field.

Thus the North pole of the magnet (the magnet being responsible for the field under consideration) is imagined as a sort of "source" of the magnetic force field, and the South pole as an "absorber" or "sink." What happens to the field between its disappearance at the South pole and its re-appearance at the North pole is tied in with the theory of magnetism, and we will touch upon it briefly a little later on.

Before we discuss the relationship between magnetism and electric currents, let's clear up the question of direction of current flow.

CURRENT FLOW

As we discovered last month, current merely signifies charge in motion. We also found that most movement of charge takes place in the form of net electron movement, the electrons being tiny negative charges. Thus one would assume that, when we say a current is flowing in a certain direction, we mean electrons are moving in that direction.

However, in the early days when these things were decided, the unit of charge was the "unit positive charge" (in one system of units, this is the Coulomb). Thus the convention of current flow was from a positive point in a circuit to a negative point in a circuit, since this is the direction a positive charge would be expected to take.

The actual current flowing would be in the opposite direction, according to contemporary theory, since the electron is a negative charge and would thus move from negative to positive points in a circuit. However, old conventions are hard to break, so the positive-to-negative direction of current flow is still the accepted convention, and is used in the solution of most electronic problems.

It is all very confusing for beginners, but that's the way things are!

FIELD AROUND WIRE

If a current is flowing along a wire, investigation around the wire with a compass shows that the wire is surrounded by a magnetic field. As might be expected, the field is strong near the wire, and weaker at increasing distances from it.

Figure 2 (b) shows this effect. Looking along the wire in the direction of current flow (Remember — this means electrons are coming towards you in reality!), the field surrounds the wire, the lines representing the force field being in a clockwise direction.

Glancing at Figure 3 (a), we can see what happens if a wire carrying a current is formed into a single-turn coil. Inside the loop, the force fields due to

every tiny length of wire in the loop add, since they are all in the same direction. Thus we have the force field "issuing" from one side of the loop, curling around the loop, and finally re-entering the other side.

We can see the similarity between this field and that produced by a bar magnet if we look at Figure 3 (b). This similarity is the basis for the contemporary theory of permanent magnetism.

CURRENT LOOPS

In an atom of any substance there are many electrons whizzing around the centre nucleus, as we found last month. Each electron whizzing round constitutes a current circle or loop, since each electron is a charge and the definition of a current is a charge in motion.

Thus we would expect each electron to produce a magnetic field similar to that around a current-carrying loop of wire. One would think, therefore, that every atom would be surrounded by a magnetic field, and that lumps of any substance would be magnetic. However, there are two reasons why this is not so.

The first reason is that in atoms of most substances, there is no net magnetic field, as the effects of each electron in the atom are cancelled out by others. In other words, the magnetic field produced by any particular orbiting electron is compensated for by an opposite field resulting from the rest.

The second reason is that the atoms in a lump of most substances are not orientated in any particular direction, but are all jumbled together in a random manner. Thus even if all the atoms were magnetic, the net result would be zero, as all the magnetic fields would cancel out.

EXCEPTIONS

However, the atoms of the chemical elements iron, nickel, and cobalt, and the molecules of various compounds of these elements, ARE found to have a net magnetic field. This means that, if the atoms or molecules are somehow re-orientated so that they all "point in the same direction" (magnetically) a lump of the substance will have a net magnetism. This magnetism will be permanent, unless energy is expended in "re-randomising" the atoms or molecules.

This then is the explanation for lodestones and other permanent magnets. Natural magnets such as lodestones have had their component molecules all aligned by some means, so that there is a nett magnetism.

The stroking of a piece of paramagnetic substance (which is one which has inherently magnetised molecules) with a magnet causes this process of alignment, so we find that we can magnetise such substances by stroking them with a magnet.

DE-MAGNETISATION

We can de-magnetise magnetised pieces of these substances by supplying energy to the molecules, giving them the energy to lose the alignment. Thus if we heat such a lump, the thermal energy of vibration given to the molecules gradually results in "re-randomisation," with consequent loss of magnetism.

Similarly, even mechanical energy (caused by, say, hitting the material sharply with a hammer) can cause de-magnetisation.

Incidentally, a factor governing the ease of magnetisation and de-magnetisation of a substance is the energy required for altering the orientation of the molecules of the substance. This is fairly obvious since, for a paramagnetic material, molecule orientation is the only difference between magnetisation and non-magnetisation.

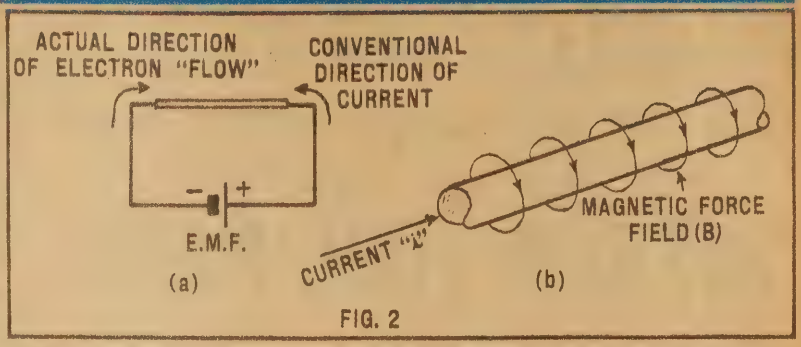


FIG. 2

Fig. 2 (a) illustrates the difference between the actual direction of electron "flow" in a conductor and the conventional direction of current. In Fig. 2 (b) we see the magnetic lines of force produced when current flows through a conductor.

When a wire carrying a current is placed in a magnetic force field, the field produced by the current reacts with the existing field, and the wire is acted on by a force. Similarly, a coil carrying a current may be either attracted to or repelled by a magnet. This is easy to understand when we remember the similarity between the field around such a coil and that around a magnet and recall that two magnets repel or attract one another.

Figure 4 shows these effects, which make possible the electric motor, the moving coil meter and many other electrical devices.

The converse of these happenings is also true for, if a wire or coil is moved across a magnetic field, an EMF is generated in the wire or coil. If the electrical circuit is made complete, a current will flow, and we find that the EMF is of such a polarity that the current produced flows in the direction needed for its field to tend to cancel the existing field.

DISCOVERER

This can be imagined as an attempt by nature to stablise magnetically the environment of the wire or coil. It was discovered in 1834 by Emil Lenz, a Russian physicist, and is accordingly known as Lenz's Law.

For an EMF to be produced (or "induced") in a circuit in this manner, it is not necessary for the circuit (wire or coil, etc.) to be actually moving through a magnetic field. All that is necessary is that the magnetic field surrounding the circuit be changing its magnitude or direction.

Whether this is achieved by moving the circuit in the field, or by altering the strength or direction of the field itself, is immaterial, since the effect is the same. As long as the field around the circuit is altering, an EMF will be induced in the wire.

APPLICATIONS

This is the principle which makes possible the electric generator, the transformer, moving coil and ribbon microphones, radio and television transmission and reception, industrial induction heating and many other devices.

An EMF is induced in a circuit or conductor when the magnetic field around it is changing, IRRESPECTIVE

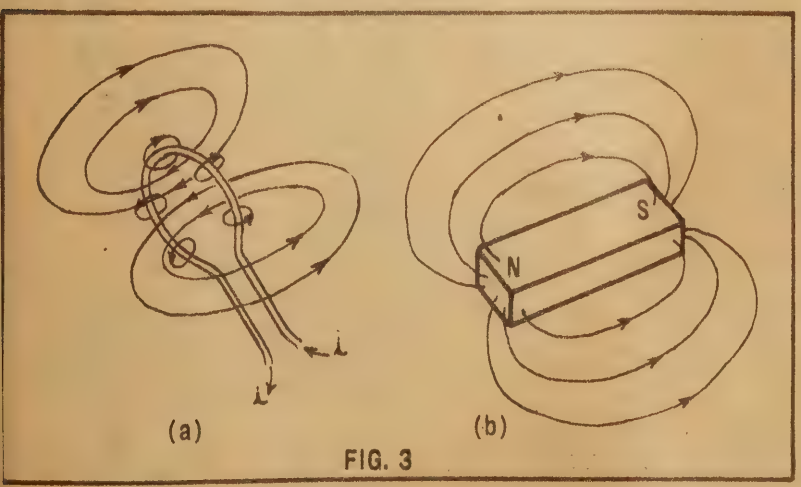


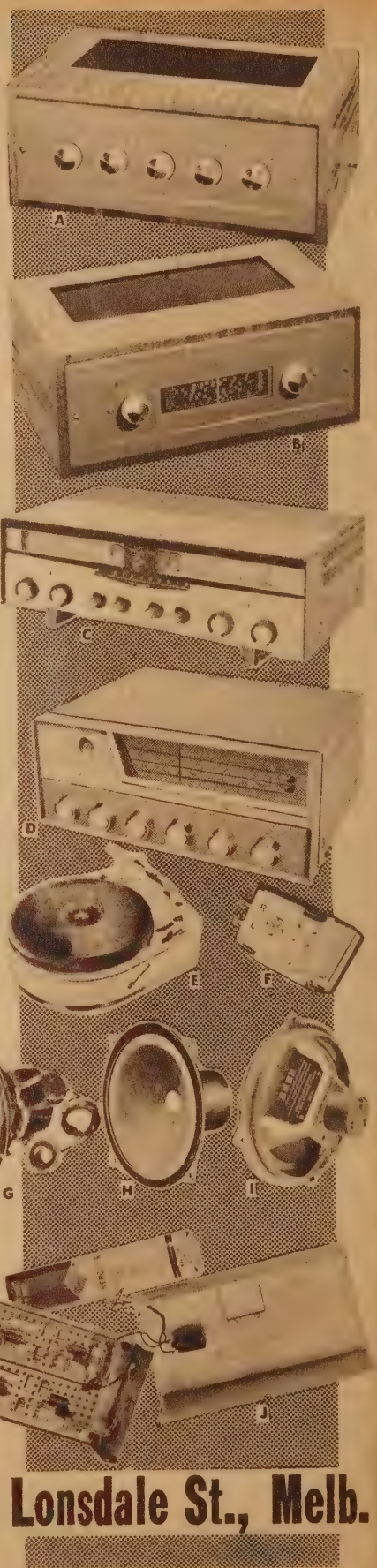
FIG. 3

Fig. 3. The force field produced by a single turn coil of wire is similar to that produced by a bar magnet.

MAGRATHS MELB. "MECCA" OF HI-FI

have the most comprehensive range of local and imported

STEREO EQUIPMENT



A. AEGIS POWERFUL STEREO SIX-88 AMPLIFIER.

A modern, ultra-linear integrated amplifier backed by the Aegis trade-mark of reliability. Choice of 3 inputs — stereo, monaural, radio tuner. Crystal pickups only. Power output rating: 8 watts r.m.s. max. Valves: 2 x 12AX7, 4 x 6BM8 plus 2 silicon diodes, type OA210. Each of 6 are double valves. Retail price: £79 17/6; Ventilated cabinet, an optional extra at £6/10/-.

B. AEGIS MARK 2 TUNER IN BOOKSHELF CABINET.

Matching cabinet to Six-88 Amplifier. New, improved model. Power supply can be drawn from existing amplifier through voltage-dropping adaptor supplied. Alternatively, an outboard power supply available (Aegis type PS/2) and can be fitted directly to tuner. Retail price: £46/11/6.

C. IMPORTED PIONEER (SM-Q-140) STEREO AMPLIFIER.

EQUIPPED WITH 2 INDEPENDENT AM & FM TUNERS. Provides an amazing degree of versatility unprecedented in amplifiers of this type. Can be used for stereo reproduction of disc recordings, AM-AM and AM-FM stereo broadcasts reception and includes perfect push-pull connection for mono use. Retail price: £149.

D. IMPORTED PIONEER (FM-R301) 7½ WATT AMPLIFIER

This model is a combination of FM tuner, amplifier, and AM Tuner with preamplifier. Its mechanical design and application of RF circuitry in FM tuner section prove successful in max. sensitivity, stability and styling as standard versatile tuner-amplifier combination unit. Retail price: £79.

E. GARRARD (4HF) 4-SPEED STEREO TURNTABLE.

WITH STEREO HEAD. Technically approved for stereo reproduction. Full 12in turntable. Plug-in pick-up head moulding will accommodate most stereo cartridges. Retail price with cartridge: £29/10/-.

F. IMPORTED G.E. VARIABLE RELUCTANCE STEREOPHONIC DIAMOND CARTRIDGE.

Full flat frequency response, 20 through 20,000 cycles, plus/minus 3 db. Unusually high and consistent channel separation, up to 28 db.
Model VR-225 (.5 mil diamond stylus): retail price, £18.
Model VR-227 (.7 mil diamond stylus): retail price, £18.

G. GOODMAN TRIAXIOM 12 SPEAKER.

3 separate specialised radiators — integrated within the one precision unit. Free-edged, low frequency diaphragm. Has own automatic, mechanical crossover. Max power handling, 20 watts. Frequency range: 20-35,000 c/s. Retail price: £52/15/. Triaxiom 8, retail price: £32/16/9.

H. STENTORIAN 10in SPEAKER (Model HF1012).

10in die-cast unit incorporating 12,000 gauss magnet. Fitted with cambric cone and universal impedance speech coil. Handling capacity: 10 watts. Frequency response: 30 cps to 14,000 cps. Retail price: £11.

I. STENTORIAIN 8in SPEAKER (Model HF816).

8in PM unit, 16,000 gauss magnet. Fitted with cambric cone, die-cast chassis and universal impedance speech coil. Handling capacity: 6 watts. Frequency response: 50-15,000 cps. Retail price: £16/5/-.

J. AEGIS TRANSISTORISED STEREO PRE-AMPLIFIER.

Ideal for operating low-gain magnetic pickup with hi-fi amplifier such as Aegis Six-88 or Mullard 5/10. Model No. STP-1; transistors used: 4 x OC71; power supply; 9 volts DC, battery 2364. Weighs 2lb with battery Size: 2¼in x 7in x 3-7/8in. Retail price: £12/9/6.

FOR THE MAN WHO STILL BUILDS HIS OWN, MAGRATHS IS THE HOBBYIST CENTRE!

J. H. MAGRATH & CO. PTY. LTD. 208 Lt. Lonsdale St., Melb.

MAIL AND PHONE ORDERS WELCOMED!
WRITE US REGARDING YOUR STEREO PROBLEMS. **FB3731**

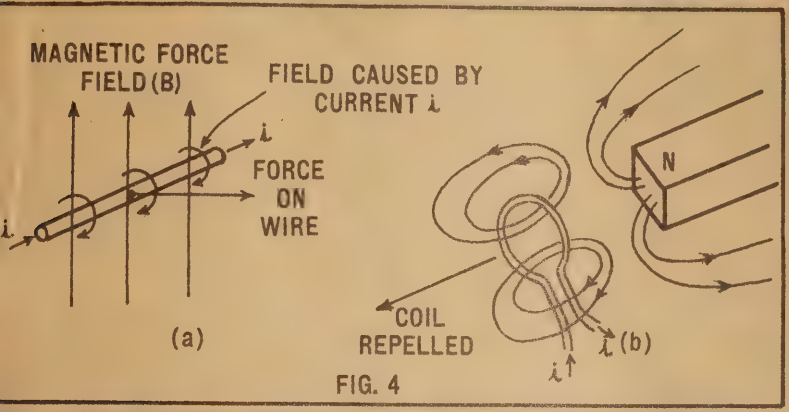


FIG. 4

Fig. 4. Current-carrying conductors experience forces when in magnetic force fields, due to the interaction between the existing field and the field produced by the current.

the source of the field or the cause its alteration. This fact enables us understand the very interesting and portant concept of self- and mutual-ductance.

Since the source of the field is im-aterial, it can easily be due to a chang-g current inside the wire itself. In her words, if we have a wire carrying current which is changing (in magni-de or direction), it accordingly pro-ces a surrounding magnetic field ich is also changing, and this field can duce an EMF back into the wire.

TABILISING EFFECT

According to Lenz's Law, the EMF ll cause a current to flow in the wire ich opposes the change of current re-onsible for the field change. It's the l story of stabilising effects: If we try change the value or direction of the rrent in a wire, the surrounding mag-tic field is changed with it, and this duces an EMF back into the wire ich tries to keep the current constant. The faster we try to change the cur-it, the faster the magnetic field anges, and the bigger the induced MF.

The whole effect here can be des-bed as a quality of the wire; as its rrent-regulating" property, or its "re-sistance to current change" property. This is called its "self inductance" and is measured by the size of the induced EMF for a given rate-of-change of current. The unit of self inductance is the Henry, defined as an inductance which develops one volt of resisting or "back" EMF when the current changes by one ampere per second.

The inductance of a given length of wire is increased if it is coiled up, since each wire loop is in the large resulting field of all the loops. For a given change in current, this total field will change by a large amount, so for a given rate-of-change of magnetic field will be larger. Thus the induced EMF is larger, and we say that the wire has a larger (self) inductance.

Similarly, if we surround the wire or coil by a substance which magnetises more intensely than free space for a given current (i.e., it has a greater permeability), the inductance is also increased. The magnetic field will again change by a larger amount (since there is more to change) in the same time, the EMF will be larger, and thus the inductance is also greater.

Moving coil meters are but one application of the effect shown above.

TRANSFORMER

The transformer also relies on the fact that an EMF is induced in a wire due to a changing field around it, but in this case the changing field is due to another wire. In other words, a wire with a changing current produces a changing magnetic field which induces a current in another wire in the field.

This effect is known as mutual induction, and is still measured in Henrys. However, the Henry of mutual induction is when one volt is induced in a wire when current is changing at the rate of one ampere per second in another wire.

It thus depends on the shape (i.e, whether they are coiled or not), the position and orientation (i.e., whether they are close together, and aligned for maximum common field) and the nature of the environment of the two wires.

This brings us to the end of our discussion of fundamentals, Tom. Next month we will begin the discussion of electronic measuring instruments with the moving coil meter, and its applications in the measurement of current, voltage and resistance.

R. H. OXFORD & SON PTY. LTD.

Mullard 2 Stereo, fully Wired and Tested, 25gns. Plus 25 p.c. tax.

Mullard 2 Chassis Box, 40/ plus 25 p.c. tax.

Brown Front Panel, 19/6, plus 25 p.c. tax.

R. TV & H. TYPE STEREO, RADIO & TEST EQUIPMENT SUB KITS

Low Input Preamp Box	2	0	0
Program Source Box	2	0	0
Printed Brown Front Panel		19	6
Engraved Brown and Red Figures, Aluminium Front Panel	2	0	0
10W or 17W Stereo Chassis	2	5	0
Stereo 5W Radiogram	2	5	0
Stereo Amp. Cabinet, Chassis and Front Panel	4	17	9
Transistor Inter Com. Amp.	1	12	6
35W P.A. Amplifier Chassis Cover	2	19	6
P.A. Mixer Unit	2	19	6
17W P.A. Amp	2	19	6

All above Stereo and Radio plus 25 p.c. tax.

TEST EQUIPMENT

Case, Chassis and Printed Front Panel			
Sweep and Marker G'rator	5	18	6
Wide Band Scope	10	19	6
Senior V.T.V.M.	4	13	6
Bench V.T.V.M.	2	14	0
Audio Signal Generator	4	13	6
R. C. Bridge	3	4	6
Audio Distortion	3	4	6
Voltage Supply Regulator	4	17	6
Simple Pattern Generator	3	4	6
Audio Square Generator	3	18	6
Sweep Generator	3	4	6
Modern Standard C.R.O.	9	14	6

Any above with Engraved Front Panel £1/15/ extra.

FRONT PANELS

Any Panels for above, Engraved, £2/10/; Printed, 19/6.

INSTRUMENT CASES

Finished in Grey Bake Hammerdok.			
MC5A 9 x 6 7/8 x 5½	1	2	6
MC82A 13 x 8 6 7/8	2	0	0
MC87A 15 x 9 x 7	2	10	0
SF7A 7½ x 7¼ x 7¼	1	2	6

OTHER CASES AVAILABLE.
MC6—MC7—MC67—MC81—MC811—MC79—SF7—SF79—SF71—SF8—SF10.

All Test Equipment and Instrument Cases plus 12½ p.c. sales-tax.

MacKinnon & Nicholls Pty. Limited, 468 Collins Street, MELBOURNE.

Martin de Launay, Darby Street, NEWCASTLE.

Chandlers Pty. Limited, Charlotte Street, BRISBANE.

R. H. OXFORD & SON PTY. LTD.

97 MARRIOTT STREET, REDFERN. N.S.W.

Telephone 69.3764 **Nos. 69.3829**

Here is the new 3-inch CRO with two of the probes which help extend its range. On the left is the cathode follower and on the right is the 100 to 1 divider. A demodulator probe is discussed in the text.

High Performance 3inch CRO

Part Two

Here is the second and final article devoted to the construction of the new 3-inch oscilloscope. This month we are discussing adjustments to the vertical amplifier for maximum response and some other points of interest.

By John Barker and Brian Cleaves

LAST month we were able to describe in fair detail, the physical layout and the mechanics of the case and chassis, the concentric knobs, the CRT mounting and various other constructional details. We will commence this month with some discussion of the factors affecting the response of the vertical amplifier.

STRAY "C"

As mentioned briefly in the previous issue, the main reason for attenuation of the higher frequencies is the presence of stray capacitances, and any attempt to extend the response must involve cancelling some of their effect.

A part of the total stray capacitances are those existing between the valve electrodes themselves. We can do very little about them other than choose valve types which are good in that respect. Unfortunately there are other considerations, such as Gm and the consequent overall gain, which means that we must make some compromise. In regard to just such considerations, the 6BX6 is a reasonable choice.

Miller effect will increase the capacity appearing at the input of each stage and for purposes of design this capacity is considered as part of the load on the previous stage. However, since we are using pentodes, and the gain of the stages is not great anyway, the Miller capacity will not be too serious.

The input capacity of the vertical amplifier will be of the order of 25pf at the terminals. This will include some small Miller capacity and that due to the proximity of the switch and components to the chassis. Its effect can only be minimised by the use of low capacity probes as will be discussed later.

The remainder of the strays are those contributed by capacitances existing between wiring and components and the earthed chassis. We cannot reduce these to zero but we can limit them to a minimum by intelligent layout and careful wiring.

Even with proper care the strays are likely to be not less than about 20 pf per stage and this means that at 2 Mc there will be an effective shunt impedance of about 4200 ohms across whatever plate load resistance we already have in the circuit.

In order that this shunting impedance will have a minimum effect at high frequencies we have to start with low plate load resistors and put up with the resultant loss of gain. This again is only of limited use because the loss in gain must be made up by adding further stages of amplification, which is expensive and cumbersome.

PEAKING CHOKES

The next most usual step, then, is to add peaking chokes in series with the plate load resistors. The value of each choke is selected so that it will resonate with the stray capacitance, at a frequency just higher than the normal upper limit. The peak produced by the resonant circuit just compensates for the fall-off due to the strays on their own.

Another way to look at the effect of the added choke is to think that its presence tends to increase the plate circuit impedance as the frequency increases. For a while at least, the increase in gain due to the choke more than offsets the fall due to strays.

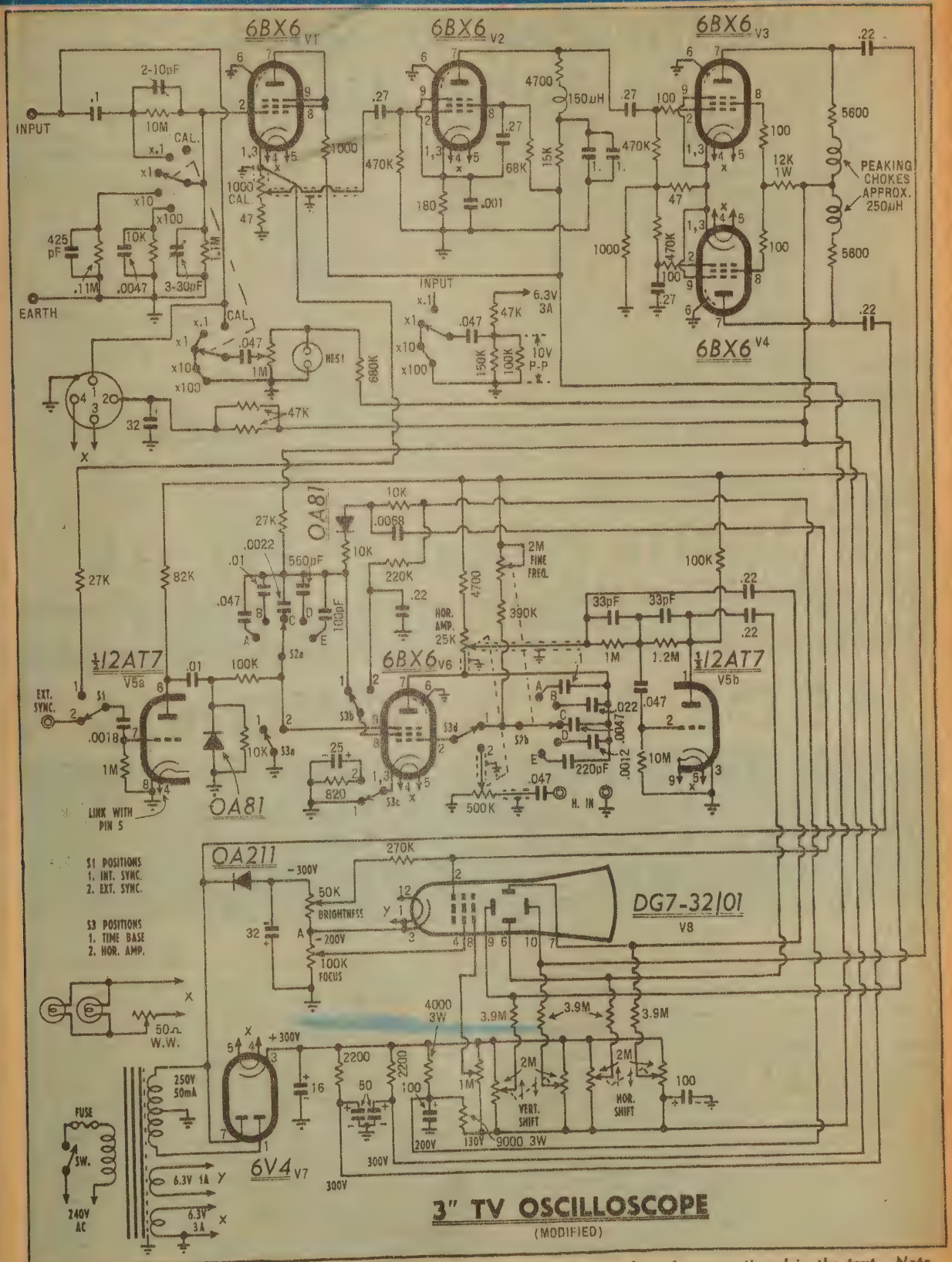
The general aim of this procedure is to extend the response as far as possible without introducing peaks. Too great a value of inductance will cause a peak which in turn may cause overshoot when a typical "peaky" TV wave form is being viewed.

IMPROVED CIRCUIT

The 150 uH chokes shown in last month's circuit produced the maximum extension of response with just a slight rise above the mid-frequency level. The slight rise amounts to less than 1/3 of a db, so we can neglect it. This response is shown in curve 2 on page 71. Curve 1 is that of the uncompensated amplifier.

During the preceding month, how-

NEW CRO WITH ADDITIONS AND MODIFICATIONS



3" TV OSCILLOSCOPE

(MODIFIED)

The circuit is generally the same as that of last month and all the changes have been mentioned in the text. Note the astigmatism pot suppling HT to pin 8 of the CRT; an optional extra to improve overall focusing of the trace. Note also the changes in the vertical amplifier; an extra peaking choke in the plate circuit of V2, a different screen dropping resistor, and slightly increased plate load resistors, for V3 and V4. An alternate, simpler calibrate voltage source is shown, for use where line voltage variations are not serious.

CONVERT YOUR MICROPHONE STAND FOR BOOM USE

Ideal for Stereo Recording and Individual Performer Pick-up.

Will attach to any Stand with 5/8in 26 TPI thread.

Supplied with 5 feet 5/8 inch Chrome Plated Boom Arm Tube, threaded one end 5/8in 26 TPI.

TYPE 108 BOOM ADAPTOR

Retail price £3/18/10 Plus Sales Tax

Full 360 degree Swivel in horizontal and vertica planes.

Boom Arm Tube can be rotated or moved in the adaptor.

Ease of release with stable locking.

MANUFACTURED BY

ZEPHYR PRODUCTS PTY. LTD.

58 HIGH STREET, GLEN IRIS, S.E.6, VICTORIA

MANUFACTURERS OF RADIO & ELECTRICAL EQUIPMENT & COMPONENTS

ACOS MICROPHONES

LAPEL MICROPHONE MIC28
Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft moulded rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel.
PRICE: £5/19/6.

VIBRATION MICROPHONE TYPE VP1
The VP1 Vibro-Voice has been specially designed for use with guitars, double bass and, in fact, all stringed instruments. With the use of this simple yet effective pick-up, together with a good quality amplifier, any instrument can be amplified. The VP1 has ample output and a frequency range which extends to approx. 6 K/cs. The tough rubber case protects the instruments from damage.
PRICE: £7/15/-.

CRYSTAL STICK MICROPHONE MIC39-1
The MIC39-1 has been beautifully styled as a hand, desk or floor stand unit, and precision engineered to the highest professional standards. A heavy die-cast liner in the microphone case eliminates the possibility of hum pick-up due to hand capacity effects. The use of a special noise-free cable improves screening and gives a greatly increased signal-to-noise ratio.
PRICE: £7/19/6 complete.
Desk stand extra.

CRYSTAL MICROPHONE MIC40
The MIC40 has been pleasantly styled in two-tone colour to give a handsome, quality Microphone of modest dimensions and unassuming price. Ideal for tape recorders with a minimum of stowage space available. £3/19/6.

Sole Australian Agents:

AMPLION (A'sia) PTY. LTD. 101 Pyrmont Bridge Rd., Camperdown, Sydney, N.S.W. Phone LA 6124

Victorian Distributors: DISTRIBUTORS CORPORATION, 403 Bourke Street, Melbourne.

er, we have been able to make further sts and we find that we can improve e overall performance by adding com-ensation to the second stage as well, nd by making minor changes to the itput, which are shown in the main rcuit diagram reproduced this month.

The changes are only slight but are orthwhile. In the output stage, 250 uH nokes are used in place of the 150s, nd the plate loads and the screen resis-or are slightly increased. An extra 50 uH choke is connected between the 7k and the 15k in the plate circuit of ie second stage and this is the only nange there.

This stage then contains both high nd low frequency compensation. At igh frequencies the 2.0 mfd to ground cts as a short circuit and the effective oad is the 4700 ohms and the choke. t low frequencies the choke acts like short circuit and the normal bass boost perates as described last month. The wo functions are independent of one nother.

PREFERRED VALUES

Since we generally try to use standard omponents wherever possible, we have rranged the circuit to suit the standard eaking chokes, which are available in 20 per cent series, rather than suggest hat constructors wind their own or alter commercial units. The actual values for he chokes in this circuit are not critical nd the normal tolerance variations should not alter the response a great deal.

The input attenuator is compensated so that it maintains constant ratios over the full frequency range of the amplifier and its trimmers have to be adjusted correctly. This is best carried out with the aid of a square wave generator. A sine wave generator may also be used (by checking the attenuator ratios at various frequencies) but it is much more tedious.

A 1 Kc square wave will contain sufficient of the higher order frequencies to give an accurate indication but any frequency up to 5 Kc will do.

Switch the attenuator to the X10 position and adjust the 2-10 pf trimmer so that the square wave is reproduced correctly without any sloping of the top and bottom—so that it is still essentially "square." Now switch to the X1 position and adjust the 3-30 pf trimmer to give a similar result.

SIMPLE ADJUSTMENT

Try next the X100 position and you will more than likely find this is correct. If not, the 0.0047 may need some small change and a few pf connected across it temporarily will indicate whether more or less capacity is required. Finally go back to X10 and check the ranges again. When the adjustments are complete dab some nail polish on to the trimmer threads and they will be permanently set.

In last month's circuit we have shown a calibrating circuit using a neon tube as a clipper. This circuit provides a 10-volt p-p clipped sine wave which remains constant regardless of variations in the mains.

A simpler arrangement would be to connect a resistive divider across the 6.3 volt filament line to produce 10 volts p-p also. The main argument against this system is that the calibration voltage varies with the mains.

There are areas where the mains voltage varies substantially as the loading changes and a 15 per cent drop is not uncommon. There are other places again where the voltage is fairly steady and the simpler arrangement might be adequate. The neon is a little more difficult to set up and it is slightly more expensive but generally it is the preferred arrangement.

The simpler 6.3 volt circuit is shown on page 65. The three resistors are 10 per cent types and the maximum error in the resulting voltage can only be about 8 per cent if the resistors are in fact at the extremes of their range.

The neon clipper works on the principle that once the tube fires, the maintaining voltage across it is constant over a wide range of current drawn through it.

COMPENSATES

If, for instance, the mains voltage should drop, the transformer secondary voltage will fall accordingly, and so too will the voltage applied to the 680K and the neon in series. The neon will then tend to draw less current so that the voltage drop across the 680K decreases in the same proportion as the original drop in the mains. The voltage drop across the neon and the 1 meg pot. remains constant.

(In last month's circuit, we have shown the series resistor to the neon as being 15k. This is incorrect and the correct value is as mentioned above—680k.)

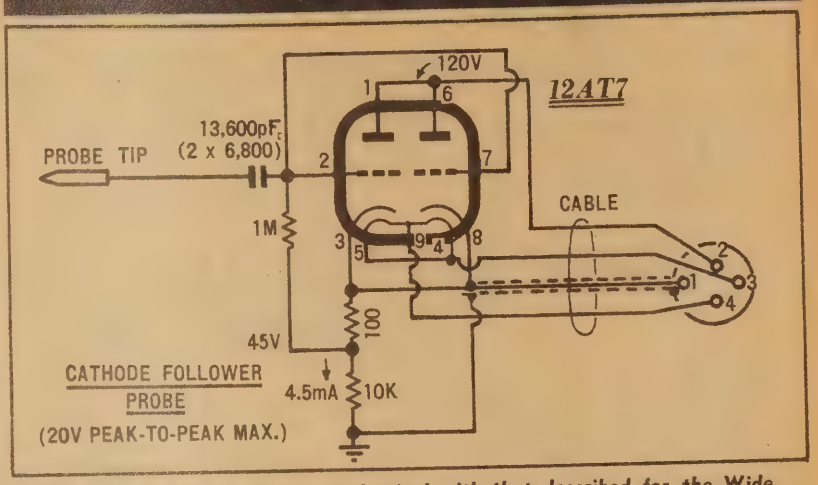
OPTIMUM CURRENT

The correct operating point for the NE2A (or the NE51 shown in the circuit) is 300 microamps, which is the current supplied by the 680K resistor when the mains voltage is correct and the transformer secondary voltage is indeed 250 volts.

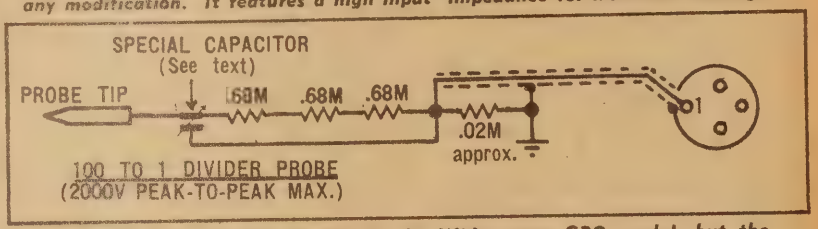
The maintaining voltage for the usual run of miniature neon tubes is not constant from tube to tube. It may be anything from 45 to 60 volts. However, they do maintain their own individual voltage fairly constantly over a substantial current range.

Now the major problem is to set the 1.0 meg. pot. so that 10 volts p-p does indeed appear between its moving arm and earth, this being the voltage supplied

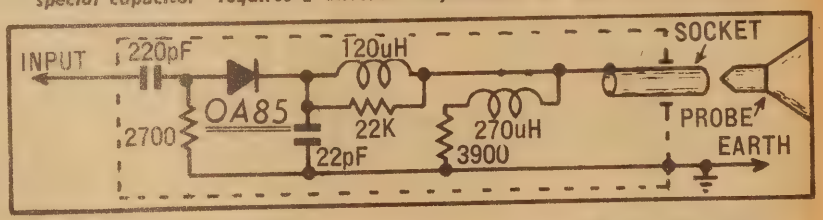
THREE VERSATILE TEST PROBES



This cathode follower circuit is identical with that described for the Wide Range CRO and one of the latter may be used with this instrument without any modification. It features a high input impedance for minimum loading.



The divider probe is also similar to the Wide range CRO model, but the "special capacitor" requires a different adjustment for the two instruments.



The demodulator probe is a new addition to our range. It may be used to test the response of sweep generator, or to "pick out" a sweep signal from a section of an IF strip under test. It also may used with the Wide Range CRO.

"Electronic Developments"

"Special" "Special" "Special"

OUTSTANDING INSTRUMENT NEWS --- FOR ALL SERVICEMEN, HOBBYISTS, ETC.

We are pleased to announce the current availability of the well-known "LEADER LSG-10" wide band signal generator. This wide band signal generator has proved an outstanding service instrument with world-wide acceptance for its exceptional **frequency coverage, accuracy** and **stability.**

We thoroughly recommend this unit to all our Country and Interstate, etc., customers, as a FIRST GRADE instrument at a Bargain Price.

We feel that hundreds of enthusiasts, who, prior to this, have never owned a Signal Generator because of the cost involved, will now become the proud owners of an LSG-10 unit. Orders received will be immediately placed in strict priority order, as we anticipate a large response. This will ensure the Country and Interstate clients being placed upon an equal basis with local buyers.

LEADER LSG-10 SPECIFICATIONS.

FREQUENCY COVERAGE 120 KCS TO 260 MCS IN 6 SWITCHED BANDS.
COVERAGE FROM .. 120 KCS TO 130 MCS ON FUNDAMENTALS.
" " .. 130 MCS TO 260 MCS ON HARMONICS.
R.F. OUTPUT OVER 100,000 MICROVOLTS
R.F. CONTROL .. VARIABLE WITH HIGH AND LOW OUTPUTS.
MOD. FREQ. . . . . 400 CPS.
A.F. OUTPUT . . . . . 3 VOLTS
A.F. INPUT . . . . . APPROX. 4 VOLTS
INT.—EXT. MODULATION.

CIRCUIT UTILISES
6AR5 — 12BH7 AND
DIODE RECTIFICATION.

PRICE £16 PRICE £16

Pkg. and freight extra

"YOU CAN'T AFFORD NOT TO OWN AN LSG-10"

ALSO Sweep and Marker Generators — Audio Oscillators — Heterodyne Frequency Meters — VTV Meters.

"Electronic Developments"

Nicholas Buildings
Phone 63-5973

37 Swanston Street
Phone 63-5973

Melbourne

to the input for calibration purposes. This is best done with the aid of another calibrated CRO, but if such is not accessible then another method must be adopted.

Probably the simplest way is to connect a pot. (of any resistance from 10K up) across the 6.3 volt filament line. Connect an AC voltmeter between its moving arm and earth and set the pot. so that the meter reads as near to 3.54 volts as possible. This will be the RMS value and hence the p-p value will be twice 3.54 volts multiplied by 1.4, which is 10 volts p-p.

Now apply this sine wave to the CRO input terminals with the attenuator in the X1 position and set the Cal. pot. so that the displayed trace occupies 1-inch vertically. If you now switch to the Cal. position you can set the 1.0 meg. pot. so that the clipped wave also occupies 1 inch.

IMPORTANT PRECAUTION

It is important to note that the signal applied to the input terminals must be disconnected, momentarily, when the input switch is turned to the Cal. position. This is because the input signal, and the Cal. voltage will both be applied simultaneously to the input and the result can be confusing.

If it is desired to arrange that the input signal is automatically disconnected in the Cal. position then an extra switch section will be required. We considered this an unnecessary expense.

We show in the accompanying photographs two pictures of the calibrate voltage. One is with the horizontal sweep set to display four cycles of the clipped wave and the other is with the sweep in the fastest position. In the latter the peaks of the waves have run together to produce the two heavy horizontal lines 1-inch apart. This is the best way to use the calibrate voltage—least confusion is caused when setting it up against the ruled graticule.

It is possible, with the aid of more neon tubes and perhaps with extra clipping diodes, to produce a far more "square" looking square wave such as is produced in some commercial instruments, but the stability is not likely to be any better. A variation of more than 20 per cent in the mains voltage results in less than 1 per cent of variation in the calibration wave.

Another small addition which may be considered worthwhile is an astigmatism control. Astigmatism is the defocusing of the electron beam usually due to a net difference in potential existing between the final anode (grid 3) and the deflection plates.

In this particular circuit we have used a dual pot. arrangement which is designed to keep the net deflector plate voltage constant and equal to that of the final anode which is about 200 volts. However, there will almost inevitably be differences because of variation in the tolerances of components and of the CRT itself.

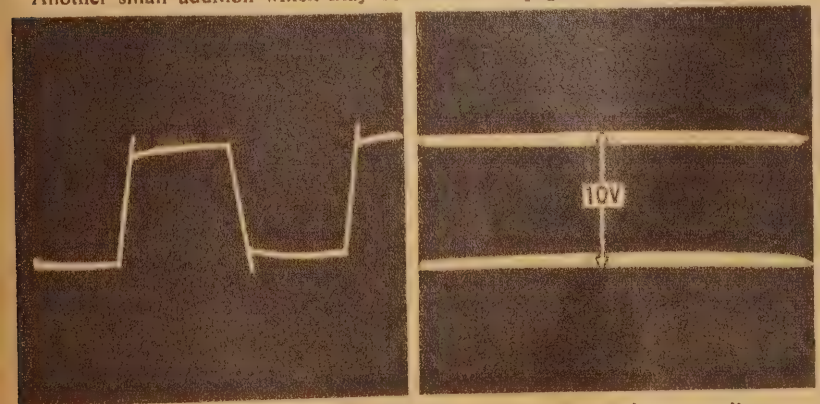
WORTHWHILE ADDITION

This is not to say that the trace will be grossly out of focus if the circuit is left as it is but in some cases the trace may not be as sharp as desired and an astigmatism correction pot. will cure the trouble.

The circuit addition for this pot is shown on page 65. We have used a chassis mounting tab pot for the purpose and it is mounted on the vertical partition just next to the CRT base. It is only necessary to adjust it once so a screwdriver pot is all that is needed.

The adjustment is best carried out with only a spot on the screen. Turn the Cal. control right off, short the vertical input terminals, turn the sweep control to the Amp. position and turn the X Amp. pot. right off. Now adjust the astigmatism pot. and the focus control together so that the smallest circular spot is produced with the brightness turned fairly well up. Try the spot in various positions on the screen and leave the astigmatism pot. in the position which gives best overall results.

We must point out that this adjustment with the spot should be carried out as quickly as possible. It is not a good idea to leave the spot sitting in any one position for any length of time because of the risk of burning a "hole" into the phosphor of the screen.



Here are two photographs of the calibration voltage from the neon clipper. The spike on the wave on the left is caused because the firing voltage of the neon is higher than the maintaining voltage—it can be ignored. When the sweep is running at maximum speed, the waveform on the right is formed.

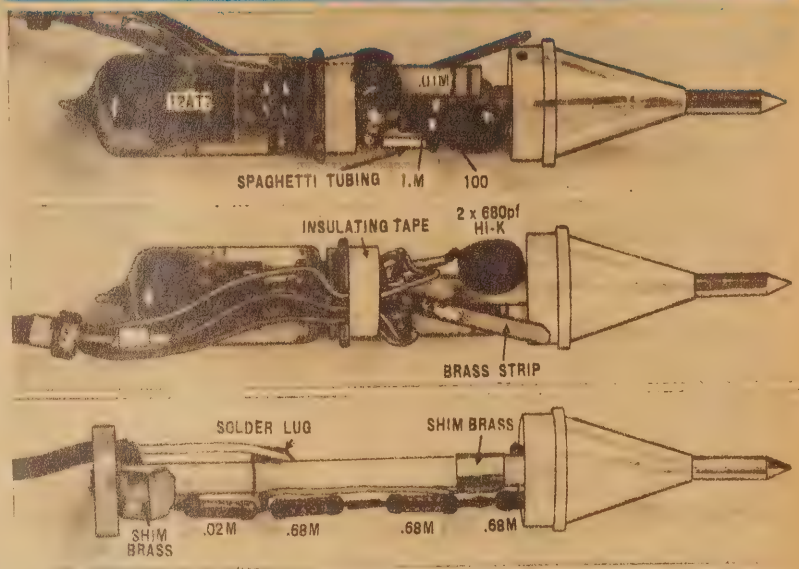
GRATICULE SUGGESTIONS

With our previous oscilloscopes we have been content to assume the use of a fairly simple graticule, if indeed we did mention the subject at all. However, we have been so impressed with the facilities offering on the better class commercial instruments, that we decided to investigate the possibilities for ourselves. The results are quite pleasing.

Sometimes, with a conventional graticule, when the ambient light is intense, it is very difficult to see the graticule clearly unless the lines are scribed very deeply into the perspex. In fact it is often necessary to fill the lines with a contrasting colour. On the other hand there will be many occasions when actual measurements are not required and only the shape of the displayed wave is important. Under those conditions the graticule is a nuisance and may have to be removed.

One solution to the problem is to edge

ASSEMBLY DETAILS OF PROBES

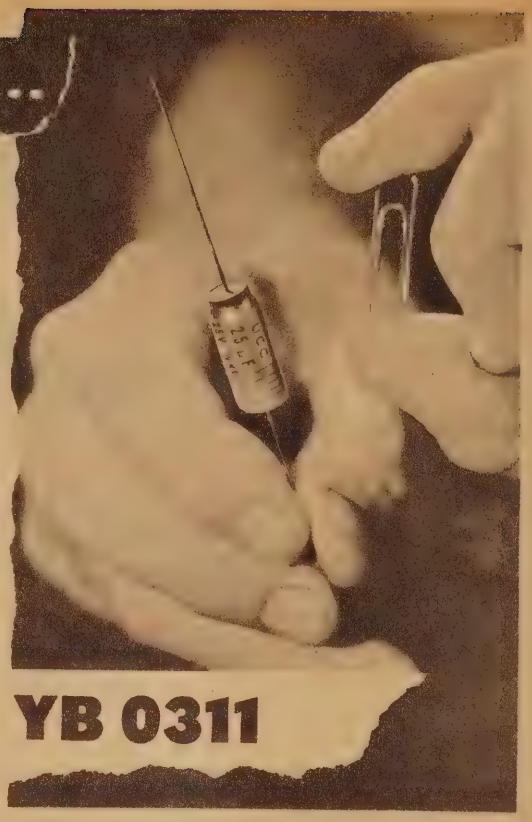


The physical layout of the original Wide Range CRO probes would be hard to better, so we are reproducing these two views of the cathode follower probe (top) and one of the divider probe (lower). The demodulator probe is a much smaller unit.

TRY THIS FOR SIZE...

SUB-MINIATURE ELECTROLYTICS

The new U.C.C. Sub-miniature range of Electrolytic Capacitors, especially designed for use with transistors, in such equipment as Hearing-Aids, Walkie-Talkies, Portable Radios, and other electronic applications where every component is scaled down to absolute minimum size. This is truly a high quality miniaturised component . . . (Write or phone for specification data).



UCC

UNITED CAPACITORS COMPANY PTY. LIMITED

433 Punchbowl Road Enfield, N.S.W.

MELBOURNE .. .. U.C.C. Pty. Limited, 486 Bourke Street.
ADELAIDE .. .. Stephen & Company, 83 Grenfell Street.
BRISBANE .. .. Tecnico Limited, 103 Albert Street.
PERTH .. .. O. F. Gamble, 931a Hay Street.
N. ZEALAND: H. W. Clarke (N.Z.) Ltd., 42-46 Cable St., Wellington.
TASMANIA .. .. .. G. A. W. Wood, 46 Brisbane Street, Launceston.

WAVEFORM

"PAYNECO"

GENERATOR

500 cycles/sec.—1 cycle per 2000 secs.

SERVOMEX LF51

CONTINUOUS WAVEFORMS

STEP WITH CONTINUOUSLY VARIABLE SLOPE

SINGLE PULSES IN TEN FORMS

SINE WAVES : 500 cps to 2000 secs per cycle.

PULSES & SQUARE WAVES : RISE TIME 5μ secs.

RAMP FUNCTIONS : LINEAR RISE VARIABLE 1 millisecond—1000 secs.

VARIABLE O.P. VOLTAGE 100 microvolts —150 volts Peak to Peak.

LOAD CURRENT TO 5 mA PEAK.

Sole Australian Agents : **RONALD J. T. PAYNE PTY. LTD.**

385 Bridge Road, Richmond, Victoria. JB 1416

ght the perspex sheet used for the grati-
ule with some suitable lamps, and vary
ne current supplied to the lamp fila-
ents so that the light intercepted by
ne graticule lines may be varied.

The lines may then be finely scribed
o that in the absence of any light from
ne lamps, they may be completely
gnored. Yet, with the turn of a knob,
ney can be made bright enough for any
ondition likely to be met in practice.

Accordingly, we have experimented
ith various lamps, and different
ethods of mounting them, and have
nally decided upon the arrangement
own in exploded view on this page.

As may be seen, there are two pers-
ex sheets. One is about one-eighth
nick and clear, and the other is much
inner and tinted green. The graticule
attern is engraved on the back of the
lear sheet and is a square of 1¾in,
ivided into five sections vertically and
orizontally. The green sheet is intend-
d to improve the contrast of the dis-
layed waveform under high ambient
ght conditions.

Some constructors may prefer to pur-
hase suitable perspex oddments from
he suppliers of that material, and cut
nd engrave the sheets themselves in
nuch the same way as we have done in
ur workshop. In that case the simplest
vay, probably, is to draw the pattern on
sheet of paper and clamp it under the
erspex on to a table or workbench, and
cratch the design into the perspex with
he aid of a scribe (or small screw-
lriver) and a steel rule held over the
attern.

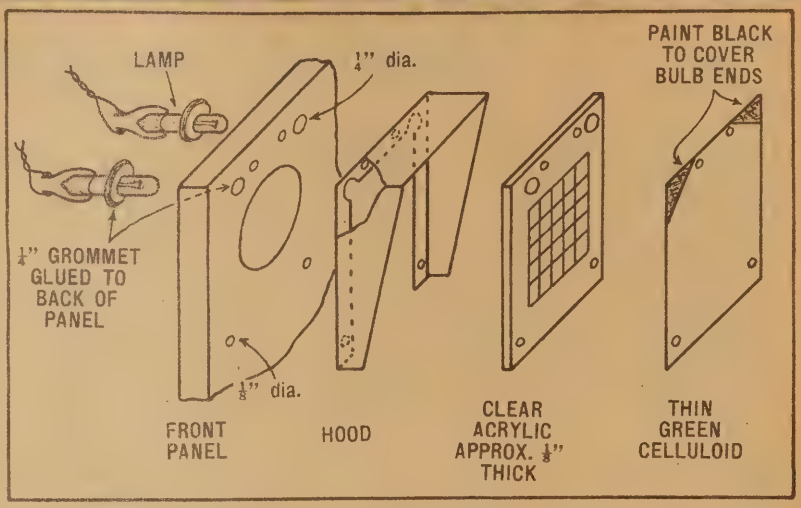
CARE NEEDED

It is well to take some care when
cribing the perspex in this manner, so
hat the instrument in use does not slip
nd scratch a deep and ugly line in any
ut the required direction. However, if
his occurs, the scratch may, possibly,
e removed by rubbing the area with
very fine emery cloth and polishing with
utting compound.

To minimise such problems we have
rranged with Messrs Watkin Wynne
nd Co., of Crow's Nest, Sydney, to
nake available in kit form all the
ecessary parts for the graticule, other
han the metal hood which normally will
e supplied with the case. Such a kit
nay save a lot of time and trouble.

The globes are telephone switchboard
ypes measuring 6mm in diameter and
bout 45mm long. They are available
n a wide variety of voltages and cur-
ents but for best results here we sug-
est 6-volt 100 mA types which give
dequate brightness.

EXPLODED VIEW OF GRATICULE



This exploded view shows clearly the manner of assembly of the graticule components. Two 1/4in grommets are glued to the back of the case around the globe holes and help to grip the globes when they are pushed into place.

These lamps have a long sliding contact on either side of the glass. For our application we found it most convenient to bend these back, in the manner indicated in the diagram, and use them as solder lugs for the connecting wires.

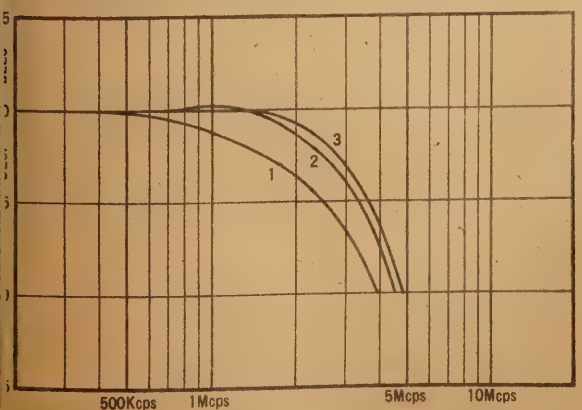
Mechanical details of the demodulator probe, the circuit for which appears on page 67. All the components are supported on a five tag terminal strip soldered to the end of the probe tip. Note the probe socket at the other end of the strip, designed to couple the unit to the cathode follower probe. See text for details.

They are fed, in parallel, from the 6.3 volt filament line via a 100 ohm wire-wound pot. The circuit is included in the main circuit diagram.

The range of operation of our new CRO may be considerably increased with the aid of suitable probes. Two types in particular will be found very useful. They are a cathode follower and a high-voltage divider probe, both of which offer high input resistance and low capacitive loading.

The necessity for such probes arises continually during normal TV servicing. As it stands, the CRO has an input capacitance, at the terminals, of about 25pF and an input resistance of about 10 meg. on all but the most sensitive range.

At low frequencies, perhaps in the audio range, the effect of the 25pF in shunting the circuit under observation will be negligible but at 2.5 mc, which is within the frequency range of the CRO, the 25pF will have a reactance of only 2,600 ohms—a very great reduction on 10 meg. The effect of the necessary connecting leads from the CRO to the circuit under test, is only to worsen the situation.



☆

The three curves here show the overall high frequency response of the vertical amplifier. Curve 1. is for the uncompensated condition, 2. is for the amplifier of last month and 3. is the result of this month's modifications. Linearity of the amplifier is also improved.

PREVIOUS DISCUSSION

These problems, and those affecting the design of suitable probes, were discussed in considerable detail in the September 1957 issue, and probes were described which were suitable for the Wide Band CRO. The same probes may be used, without change, for the present instrument, but we are only undertaking to describe the mechanical details here. For the more theoretical considerations, we suggest that interested readers refer to that issue.

The circuits for the probes appear on page 67 and the mechanical details are shown on pages 69 and 71.

The cathode follower and the divider

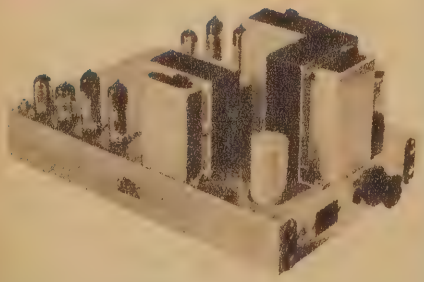
Amplifiers that are acclaimed throughout the world

The "Point One Stereo" pre-amplifier is designed so that it can be used with any Leak monaural power amplifier or a combination of any two Leak monaural power amplifiers additionally to its more normal use with the "Stereo 20" or "Stereo 50."

"The 'Point One Stereo' pre-amplifier is the most comprehensive unit in existence covering every requirement for stereo tape, disc and radio plus monaural amplification for any form of input signal . . . . it is difficult to think of any additional requirement that one would ever wish. The equipment performs with the highest performance always associated with the tradition of Leak equipment. It is a fine example of design and construction, and the pre-amplifier can be used with any other Leak main amplifiers . . . . Summing up, therefore, one can highly recommend the Leak stereo system for use with any current monaural or stereo input whether it be from pickup, tape, radio or microphone."

Extract from Test Report by J. C. G. Gilbert reprinted from the Music Trades Review, February, 1959.

Now also available :
The new LEAK "Point One" Stereo Varislope Pre-amplifier



STEREO 20 amplifier

TL/12 PLUS amplifier

self-powered
Trough-Line F.M. Tuner

LEAK . . . ***the first name in High Fidelity since 1934***

For further details contact our regular distributors throughout the Commonwealth

AUSTRALIAN NATIONAL DISTRIBUTORS: ***Simon Gray Pty. Ltd.***

28 Elizabeth Street, MELBOURNE C.1. Telephones: MF8211, MF8166.

probes are both housed in commercial probe units, which are freely available. They measure 1in in diameter and are 6in long. Moulded polystyrene pieces are used at both ends, one of these containing the probe tip.

Quarter-inch poly. rod is used in both probes for a support pillar. For the cathode follower it will need to be 1in long and tapped at both ends to take a 1-8in Whitworth thread. One end is screwed on to the metal tip inside the housing and the other end supports a 9-pin miniature socket by means of a nut soldered to the central earthed spigot. The three resistors and the coupling capacitors may then be soldered in place, in the manner indicated in the photographs.

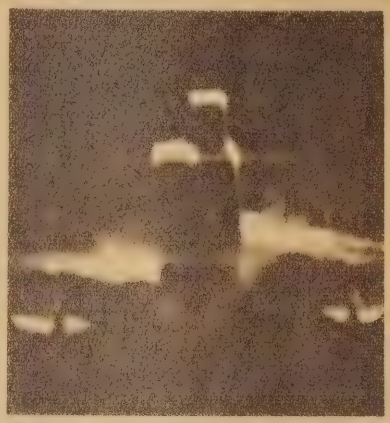
PROBE DETAILS

The five connecting wires will just fit alongside the valve to join the shielded cable to the CRO. A metal ring is soldered to the braid at this point to take the strain in the event of the cable being pulled roughly. A strip of insulating tape is then wound round the socket to hold the wires in place.

The bottom of the 10K resistor and the central spigot are both earthed to the outer case by means of the brass strip seen in the photographs. It is soldered at one end to the spigot and is long enough so that it jams between the case and the front moulding when the probe is assembled.

The divider probe is similarly constructed. The poly. rod in this case is 3¼in long with a break at 2¼in. The break is threaded to take about ¼in of 1-8in diameter bolt and a small solder lug is jammed in between the two rod sections to make a support point. This serves as a terminal for the cable and for the juction of the two divider resistors concerned.

The cable braid is earthed to the outer case by a piece of shim brass. The lower divider resistor is earthed to this



Here is a photograph of one line pulse, taken from the screen of the 3in CRO. It is quite a reasonable reproduction of the true shape, and is indicative of the performance to be expected of the instrument.

point also. The upper divider capacitor needs to be adjustable and is made from a piece of shim brass tightly wrapped around the rod near the probe tip. A length of flexible hookup joins this "capacitor" to the junction of the divider. This construction can plainly be seen in the photographs.

Both probes connect into the CRO via a four-pin mic. plug. The shield for the probe leads is earthed via the shield on the plug itself.

There are no adjustments necessary on the cathode follower probe, but the sliding trimmer will have to be set in the divider probe. This is adjusted in the same manner as the attenuator trimmers in the CRO proper. A square wave of 1Kc or thereabouts is quite suitable. The division of this probe may be accurately set by adding the necessary correcting resistor either in parallel or in series with the lower divider resistor.

INPUT CHARACTERISTICS

Both probes have an input capacitance of only a few pF. The input resistance of the cathode follower probe is about 10 meg. and that of the divider probe is about 2 meg.

The cathode follower is generally best used in the low voltage ranges up to 20 volts p-p. In this range it will handle almost any waveform likely to be met in normal circumstances with a minimum of distortion. However, at low frequencies, provided there are no sharp pulses present, it will handle upwards of 50 volts p-p. At low amplitudes its response is level up to 3 Mc. (See September 1957 issue.)

The divider probe is used in the range from about 50 volts p-p up to 2,000 volts p-p. The upper limit is set by the maximum working voltage of the resistors in the probe. The actual division of the probe may be set at exactly 100-to-1 by adding the necessary resistor either in series or parallel with the lower

(Continued on Page 124)

Buy your Coils and Transformers for the

RADIO, TV & HOBBIES 8 TRANSISTOR RECEIVER

Direct from the manufacturer —Telecomponents Pty. Ltd.

FULL PRICE DELIVERED TO YOUR DOOR—

Broadcast only kit . . . £5/-/-

Complete Dual Wave Kit . £6/6/-

POST FREE, TAX INCLUDED

Kit contains all coils, Ferrite rod or Aerial Coil, I.F.'s and audio transformer. (When ordering, please specify Aerial Coil or Ferrite loopstick).

All components are fully tested to specification, exactly as supplied for the original model receiver.

Alternatively, items may be purchased singly.

Type No.	s. d.
718 Tuned Ferrite Aerial Rod and Coil	17/6
719 High Gain Aerial Coil	17/6
739 Oscillator Coil	9/10
729 R/F Coil	10/8
919 455 K.C. I.F. Transformer double tuned, each	16/9

No extra for Sales Tax.

Type No.	
524B Driver Transformer	17/6
4301 Output Transformer for 3 ohm. Voice Coil	17/6
Additional coils for Short Wave 7-24 Mc/s Range.	
7191 S.W. Aerial Coil	10/8
7260 S.W. R.F. Coil	10/8
7302 S.W. Oscillator Coil	10/8

Postage paid within Australia.

Send cheque, money order or postal note to:—

TELECOMPONENTS PTY. LIMITED

Mitchell Road, Brookvale, N.S.W. **'Phone: XF 0221**

Interstate and Country Cheques please add exchange.

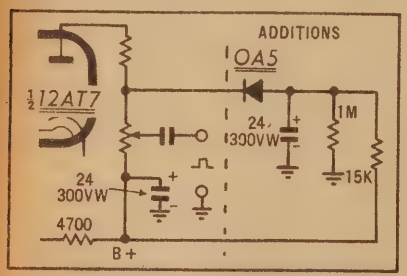
CLIPPER IMPROVES SQUARE WAVES

Here is a simple addition to the square wave section of our Wide Band Audio Oscillator which was described in May, 1960. A clipper circuit which improves the rise time of the square wave.

A Schmitt trigger was used in this instrument to provide square waves with a short rise time over a wide frequency range.

One small difficulty with this type of trigger is that when it is adjusted to produce the shortest rise time, or fastest triggering, a small spike due to overshoot is produced, which can cause confusion in some tests.

The "speed up" capacitor, which controls the switching time, is normally adjusted so that a spike just does not appear. The rise time in this condition is good, but it is not as short as is possible with this circuit.



Simple clipper circuit. The resistor values are found experimentally.

These circuit conditions were illustrated in the accompanying photographs.

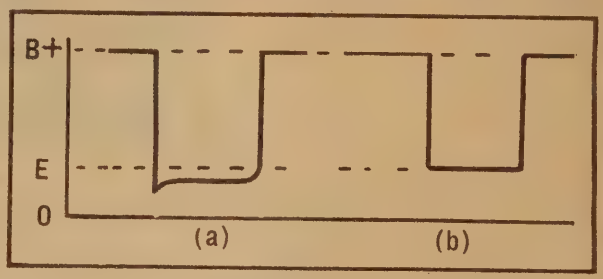
One very good solution to the problem is to arrange a diode in the manner of Figure 1.

An OA5 diode is connected between the top of the output control and a point which is somewhat less positive than B-plus. This latter point is at the junction of two resistors connected between B-plus and earth.

☆

Waveform (a) occurs with fastest rise time and no clipper. Note the overshoot which is removed by the clipper circuit as shown at (b).

☆



The square wave output is initially produced by switching the valve V2, alternately from cut-off to fully conducting. The output voltage then varies between B-plus and a lower value depending on the voltage drop across the valve and its load resistance.

This set of conditions is seen in A of Figure 2.

The cathode of the diode is connected to the output and the anode is connected to a potential E, which is just slightly more positive than the lower limit of the square wave.

This means that whenever the output voltage falls below the level E, the diode will conduct and remain conducting until the output rises above this level.

The result is that the lower part of the square wave, containing the unwanted spike, is cut off, and that the square wave has a truly square lower edge.

The correct values of the two divided resistors producing the voltage E were found experimentally by connecting a 1.0 meg pot, between HT and earth and connecting the diode to the moving arm.

The speed-up capacitor was adjusted to give the maximum rise time (the biggest spike) and the temporary pot. was set at the position where the spike was just lopped off.

Preserve your valuable gramophone records

with the

"Acos" Dust-Bug

The life of a gramophone record is largely determined by the cleanliness of its groove in the course of playing The stylus travelling along the groove creates a static electric charge on the disc surface and airborne dust is drawn into the grooves to create abrasive conditions which will rapidly destroy the record. Deterioration occurs first in the reproduction of high notes, but surface noise will quickly spread.

The Dust-bug with its accurately shaped points of nylon bristle sweeps the groove in advance of the stylus and the foreign matter removed is trapped and collected on a plush pad, which discharges all static at the moment of playing. Skilful counter-balancing of the device ensures tracking performance is maintained. Records and styli are simultaneously protected from the rasping effect of the stylus point grinding dust into the groove. Expensive records are preserved — reproduction is improved.

The clipping of the Dust-bug to record players or changer arms is a matter of seconds. No further adjustment is required apart from very occasional damping of the plush pad with the antistatic solution supplied free, in easy to apply container.

The "Acos" Changer Dust-bug is doubly important in the case of stereophonic records.

PRICE: £2/15/-.

Exclusive Australian Agents:—

AMPLION (A'SIA) PTY. LTD.
CAMPERDOWN, SYDNEY, N.S.W.

SOUND FOR 8mm AMATEUR FILMS

For many years amateur movies have been a popular hobby. One particular film gauge, 8 mm., has been steadily rising in popularity due to its relative economy. When synchronised sound is desired, however, this gauge presents difficulties not found in the other gauges. This article attempts to summarise these difficulties, and suggest the most practical solutions.

By Jamieson Rowe

This is the "CIRSE-SOUND," a completely self-contained 8mm magnetic stripe sound projector. The projector fits inside the speaker box for transport. (Courtesy Magnetic Products Pty. Ltd.).

'O achieve the maximum amount of audience impact for a film, sound needed. In some cases, the desired 'ect can be obtained by the use of n-synchronous sound sources. These :lude tape recorders, gramophone :ords, or simply the voice of the pro-:tionist himself.

For many cases, however, synchronous und is required to give the desired 'ect, and it is here that the 8mm filmer n find himself "out on a limb." Most the methods of providing syn-ronised sound for the larger gauges ve disadvantages when applied to 8mm n and its particular application.

_IKELY REQUIREMENTS

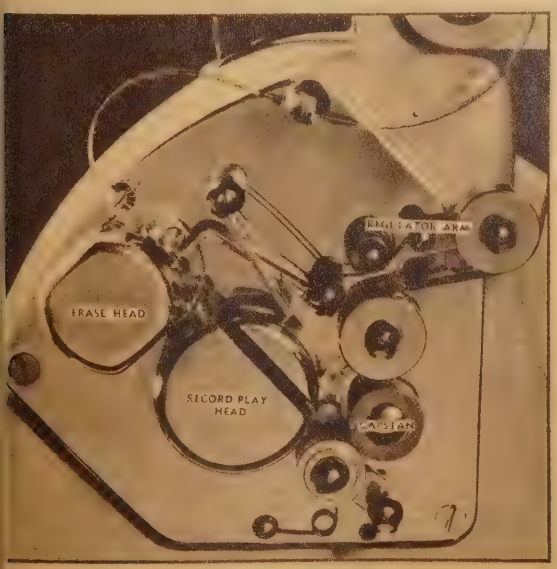
Before considering these, however, let list the various forms of synchronised und likely to be required by the ama-ır.

(a) He may require to make "on the ɔt" synchronised sound records asso-ıted with the sound being filmed, in-ıding dialogue which must be perfect-synchronised when played back. This one of the most ambitious require-:nts.

(b) He may wish to screen films likely become available for hire or loan from various organisations, such as is now common practice with 16mm films.

(c) He may require to add synchronised sound, in the form of commentaries, sound effects, musical background, etc., to films already exposed and processed. Also, he may try a little "post synchronising" on special occasions.

Some may require all three, others may require only one, or two particular ones in combination.



☆

The magnetic sound head of the "CIRSE - SOUND" stripe projector is similar to a tape recorder. A separate motor drives the capstan, and a film - actuated arm is used to synchronise the two motors. (Courtesy Magnetic Products Pty. Ltd.).

☆

Next let us examine the various common methods used to obtain synchronised sound, and see how they stand in relation to 8mm film and the above requirements. There are three main points of interest in this regard—cost, quality and ease of operation.

The oldest and most established method used in the larger gauges (9.5mm, 16mm, 35mm and up — at present!) is the optical track. Basically this method consists of converting the original sound signals into light fluctuations, and photographing these fluctuations on a section of the film used to take the picture.

REPRODUCTION

The sound track thus formed is not projected on to the screen when the film is viewed, but is used to vary the light reaching a photo-electric cell. The electrical fluctuations formed by the cell are used to operate a loudspeaker (after amplification) as they are identical to the original sounds.

The ease of operation of this method is high, since the sound is on the same storage medium as the picture. Thus synchronisation is automatic, and the equipment, being a single combined unit, is not extremely bulky.

However, the equipment required is rather expensive, particularly for the recording process. This is a strong point against optical track sound for 8mm, but an even stronger point is the sound quality to be expected.

The optical system uses extremely fine transverse slits both to record and reproduce the optical track. These fine

Homecrafts PTY LTD

AUSTRALIA'S LARGEST Radio, Television and Hobbies SPECIALISTS

290 LONSDALE STREET, MELBOURNE — FB3711

We have everything for the HI-FI enthusiast

TRADE IN YOUR OLD DISTORTED SPEAKER ON A NEW ROLA LOUDSPEAKER.

Model	Price	Model	Price
2C	£1 19 0	3C	£1 17 0
4C	£1 17 0	4F	£2 6 0
5C	£2 0 6	5F	£2 8 0
5FX	£2 10 6	5-4C	£2 2 0
5-4F	£2 10 6	6-H	£2 11 6
6M	£3 6 0	7-5H	£2 13 0
7-5L	£3 2 6	8H	£2 19 0
8K	£2 12 6	8M	£3 14 0
8MX	£4 10 6	9-6H	£3 0 6
9-6L	£3 10 0	10-3G	£2 14 6
12K	£3 6 0	12M	£4 16 6
12MX	£5 18 0	120	£6 0 0
120		12UX	£24 5 0
Deluxe	£6 10 6	120X	£11 4 0
12U	£22 3 6	12PX	£15 5 0

Scope Soldering Irons

Standard Iron .. £2/16/
Transformer .. £1/14/

SCOPE PARTS

Elements .. 1/2
Coppertips .. 11d
ED Mini Soldering Iron 6V or 12V .. £2/8/0
Trans. to suit .. £1/9/3
Ersin Multicore solder .. 12/7
Astor Car Radio
Cowl and Universal Aerials .. £2/19/9

BATTERY CHARGERS

Nilson 6 Volt 4 amp. .. £11 10 0
Nilson 12 Volt 2 amp. .. £11 10 0
Dial Range
6 and 12 Volt .. £12 6 0
Battery Hydrometers
Ormiston .. 11 0
Hydrometer floats .. 2 6

R. & H. INSTRUMENT PANELS

Audio Gen. RC bridge
VTVM, etc. .. 17/- plus tax

SOCKET PUNCHES

Pipgras Screw Type

¼in .. 28/11 | 7/8in .. 50/8
5/8in .. 28/11 | 1in .. 54/8
¾in .. 37/4

VAR. CONDENSERS

RCS Min 100 mmfd. .. 15/8
Strom 2 gang .. 19/6
AWA 2 gang min .. 29/3
AWA "3 gang" min .. 39/6
Ducon Toroidal Core .. 10/0
Ducon Ferrite pot for R and H Portable Sets .. 9/0
Buron Crystal Set Coils
Untapped No. 1 .. 9/6
Tapped No. 2 .. 9/3

Mail orders promptly handled. C.O.D. if you wish.

WHEN YOU BUY ANODEON

TV Picture Tubes you are buying quality. All sizes in stock.
ALSO FULL RANGE ANODEON DIODES AND TRANSISTORS IN STOCK.

VAN RUYTEN INVERTERS

32V to 240V 100W .. £27 19 2
32V to 240V 150W .. £33 4 3
12V to 230V 100W .. £29 14 3
12V to 230V 100W .. £20 7 6

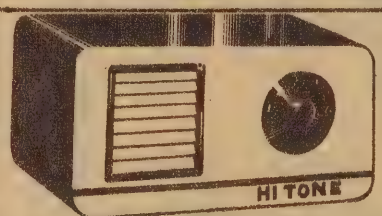
Supplied complete with test leads.

BRAND NEW MULTIMETERS 61/- Plus postage.

Meter 0-1MA 1000 OHMS PER VOLT

A.C. RANGES	D.C. RANGES	CURRENT RANGES
0 — 10V	0 — 10V	0 — 1MA
0 — 50V	0 — 50V	0 — 100MA
0 — 250V	0 — 250V	0 — 500MA
0 — 500V	0 — 500V	
0 — 1000V	0 — 1000V	

OHMS RANGE—0-100,000 OHMS.



SPECIAL BARGAIN

1 TRANSISTOR SET

NORMAL PRICE £7/15/

Bargain at 50/ plus Tax 25%

Set comprised of the following parts.

1 Coil and Ferrite Rod Tuner.
1 Rola 3C Speaker.
1 Rola E33 Speaker Transformer.
1 T.S.2 Transistor.
1 GD3 Diode.
1 50ft Aerial Wire.
2 Egg Insulators.
Hook-up Wire.
1 Cabinet 9in x 5in x 3½in.
1 180pf. Mica Capacitor.
1 .001/600 Capacitor.
1 1Meg. ½-watt Resistor.
1 4 Terminal Tag Strip.
1 Dial Knob.

All for the price 50/ plus 25% Tax

R. & H. T.V. CHASSIS

with EHT Box .. £3/0/0 plus tax
Philips Permeability Tuners NP1200 .. £1/15/0
Union 2-transistor Miniature Portable Radio with headphone earpiece .. £5/0/0 plus tax

RECORD PLAYERS & CHANGERS

Collaro 4-Speed Player	£10 10 0
Collaro Conquest 4 speed changer	£13 0 0
Collaro 4T200 Transcription	£26 15 0
Collaro 4T200 less Pick-up	£20 0 0
Philips Stereo Player AG2009	£13 13 0
Garrard RC121 Changer	£20 17 6
Garrard RC88/4 Changer	£24 17 0
Garrard 4HF Player	£29 16 6

SUPER BARGAINS

TMK Tester 20,000 ohms per volt. DC and AC to 1000 V. Resistance to 10 megs. MA.—50 micro amps to 500mA.
£6/15/ plus 12½% Tax.

THE ANSWER TO THE HI-FI MAN'S DREAM

THE ORPHEUS "SILEX" 4-SPEED TURNTABLE £37/14/8

SPECIAL GD3 DIODES 3/- plus tax

NEW 4-SPEED GARRARD RECORD CHANGERS, £14 plus tax

These new 4 speed record changers are equipped with high fidelity crystal pick-up and sapphire needles. Can also be used as a manual player.

NEW 3in PER-MAG SPEAKERS 20/. Post and Packing 3/6.

HIGH IMPEDANCE HEADPHONES NEW 27/6. Post 2/6.

NEON TEST SCREWDRIVERS 8/6 ea.

COMPLETE RANGE

A & R

Audio and Power Transformers always in stock

MAIL ORDERS PROMPTLY HANDLED. C.O.D. if you wish.

Call or Write NOW! **290 LONSDALE ST., MELB. FB3711.** ***Trade Supplied***

slits are essential to achieve adequate frequency response for a given film speed. (The reason behind this is obvious—the response of the system must be zero when, at the frequency concerned, the scanning slit represents one wavelength.) Thus the slower we wish to run our film, the smaller we must make this slit if the frequency response is to be constant.

Since 8mm film is narrow, each picture is very small, and thus when the film is being projected at the normal speed of 16 frames per second, the actual film speed is only about 2.4 inches per second. At this extremely low speed, an exceedingly narrow slit would be required for an acceptable frequency response.

TOO SMALL

In practice, the size needed is impractical because of the difficulty in adjusting and keeping clean such a tiny slit. In addition, the optical system would be very inefficient, necessitating high amplification. At this very low speed the emulsion grains would also affect the sound quality, and the system would have a high noise level.

The optical system has been tried on 8mm film at various times, but it was found that even with virtually grainless colour film the system was completely unsatisfactory. It seems unlikely that any developments will appear in the near future to remedy this situation.

Another way of obtaining synchronised sound is to record the sound on a separate medium. This may be magnetically, on magnetic film or tape; or optically, on another film. The optical method produces good quality, since the sound film may be run at a suitable speed; but it still possesses the drawback of high cost.

Recording the sound on normal magnetic tape using a tape recorder can produce excellent sound ouality, but it too involves difficulties. One is that it is necessary to interlock the projector and tape recorder to preserve even rough synchronism. This is true even if both machines use "asynchronous" induction motors — which run at a constant speed only if the load is constant.

The machines can be interlocked either mechanically or electrically. The mechanical method tends to be easier to operate but harder to arrange initially, as spindles running at equal speeds on the two machines must be provided. The electrical system is easier in this regard as the coupling is purely electronic and usually more convenient to arrange. However, both systems tend to be rather bulky and clumsy in operation.

VARIOUS APPROACHES

Thus all sorts of elaborate synchronising units have appeared. Most of these work but, from the ease of operation point of view, they are more or less failures. For transport one has at least three units, and the projection process becomes rather complicated.

In any case, the mere provision of a satisfactory interlock does not automatically solve our synchronising problems. All it does is to emphasise yet another problem — tape slip and stretch. This is an effect inherent in all friction type tape transport systems. The slip or stretch seldom becomes apparent as far as the actual sound quality is concerned, but becomes very obvious when one tries to synchronise the tape with film for any appreciable period of time.

Stretch is a problem with all tapes but is most obvious with the newer thin-based long-play tapes. Temperature and humidity variations make playing times of these tapes vary quite considerably. Thus for even rough synchronising of tape to a movie film, the thicker base normal play tape is essential.

The recording of the sound on a separate magnetic film (or magnetic tape provided with sprocket holes) solves this problem. Since the recording medium is positively driven by means of toothed sprockets, slip is impossible and stretch has no effect. The machine and projector still have to be synchronised, but this problem can be solved as before.

16mm PERFORATED TAPE

The medium used in this method is usually 16mm film fully coated with oxide — in effect, 16mm perforated tape. It is run at the normal sound speed of 24 perforations per second, and is capable of really superb results.

8mm perforated tape is also available, at a cost which is about half as much again as normal magnetic tape. In a machine specially designed to take it, this can be synchronised just as easily, and is also capable of extremely good results.

However, this system still possesses the disadvantage of bulk — at least two units are needed to show films. Another point is cost, due to the difficulty in making a sprocketed tape machine which is free of flutter or "sprocket jerk." Thus such a machine costs more than a good normal type tape recorder.

The third system of obtaining synchronised sound is by means of a magnetic track or stripe on the actual film. On 8mm, the stripe is placed between the sprocket holes and the edge of the film, and is thus only about 0.03 inch wide. The recording is done in exactly the same way as normal tape recording, with the signal recorded as magnetic fluctuations in the stripe.

This system is not new, having been in use for several years. However, when first introduced magnetic recording as a whole was not nearly as advanced as it is today. Tape speeds of 7.5, 15, and even 30 ips were commonly used to obtain satisfactory performance, and anything less than 7.5 ips was looked upon as a "speech medium" only. Today, the position is quite different. Speeds as low as 1-7/8 ips are being seriously considered for home entertainment, making the 2.4 ips of 8mm an attractive speed by comparison.

With well-designed equipment the sound quality obtainable is really good—better than the majority of 16mm opti-

PERFORATED TAPE RECORDER

The "SYNCROSOUND" 16mm perforated tape recorder uses a synchronous motor drive and has a built-in synchroniser. Typical of this type of recorder, it is capable of very high quality. (Picture courtesy Herofon Engineering).

AWA RONETTE

MICROPHONES & ACCESSORIES

Type S742

£16/9/6

Duo cell, omni-directional suitable for cable suspension. Technical pamphlets mailed on request.

NEWTON McLAREN LTD.

17 LEIGH ST., ADELAIDE

and leading wholesalers.

MASTER ELECTRICS PTY. LTD.

A WHOLLY OWNED SUBSIDIARY OF MOTOR SPARES LTD.

TMK MULTIMETERS

TP5S T.M.K. Multimeter —
This is exceptionally good value, ideal for Radio, TV and Transistor Sets for Radio and Automotive mechanics, etc.
Sensitivity of meter is 20,000 ohms per volt on DC and 10,000 OPV on AC.
Size of Meter, 3 inches.
Case is metal with black bakelite front panel.
Dimensions: 3½in x 5¼in x 1¾in.
Weight: 15ozs.

Ranges are as follows:—

DC VOLTS: 0-10, 50, 250, 500, 1000.
AC VOLTS: 0-10, 50, 250, 500, 1,000.
DC Current: 0-50 micro-amps 0-5, 50, 500 mA.
Resistance: 0-10,000, 100,000, 1 meg, 10 meg.
Capacity: .0001 to .005 mfd.
.005 to .1 mfd.
Decibels: .20db to plus 36db in 2 ranges.

Price only **£6/15/-** plus 12½% S. Tax.
Total Price **£7/11/11** plus postage.

MG310 T.M.K. Multimeter —
An exceptionally well-built reliable meter which will stand up to any amount of hard work, ideal for Radio serviceman, electrician, motor mechanic, etc.
Sensitivity of Meter: 20,000 OPV DC. 10,000 OPV AC.
Size of Meter: 3½ inches.
Case is metal with black bakelite front panel.
Dimensions: 3¾in x 5¾in x 2-3 8in.
Weight: 23ozs.

Ranges are as follows:—

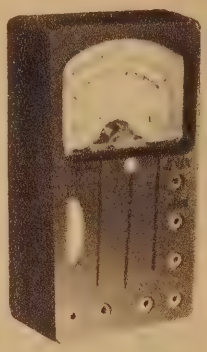
DC VOLTS: 0-5, 25, 100, 500, 1,000, 5,000.
AC VOLTS: 0-5, 25, 100, 500, 1,000.
DC Current: 0-50 micro-amps, 0-5, 50, 500 mA.
Resistance: 0-6000, 600,000, 6 meg, 60 meg.
Capacity: 100 uuf to .01 mfd, .002 to .3 mfd.
Inductance: 20-2000 henry.
Decibels: —20 to plus 30 in 2 ranges.

Price **£10/2/6 plus sales tax.**
£11/7/10 plus postage.

FOUNDATION KIT SET

Consists of Bakelite Cabinet, Dial Assembly, Speaker Silk, Chassis with 2-gang Condenser, 8 mfd 525 volt Condenser, 4 octal Sockets, Terminal Strips, etc. All mounted as illustrated. This can be used to make 4 or 5-valve Mantel Radio, Transistor Mantel, etc.
Size of Cabinet is: 11¼in x 7¼in x 6¼in.
Size of Chassis is: 9¼in x 6¼in x 5¼in.

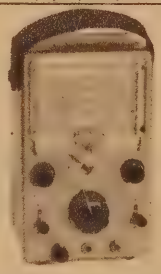
PRICE ONLY £2/10/- EACH.



KEW MULTIMETERS

Size 4in x 2in x 1½in. Complete with test prods. Ranges AC and DC.
Ranges AC and DC Volts, 0-15, 150, 1,000.
DC Current: 0-150 mA.
Resistance: 0-100,000 ohms.
Sensitivity: 1,000 ohms per volt.
An ideal pocket meter for the serviceman, motor mechanic, home constructor.

Reduced from 79/6 to 49/6
plus postage.



TEC VACUUM TUBE VOLTMETER

Model PV58

The PV58 is ideal for service on TV Sets, Transistor radios and many other electronic tests. It will measure DC Voltages, AC Voltages, ohms, RF and high voltages, also has Zero Centre Indication.
Valves used are 6AL5 and 12AU7
DC and AC Voltages: 1.5, 5, 15, 50, 150, 500, 1500.
Ohms: 0-100, 1,000, 10,000, 1 meg, 10 meg.
High Voltage with HV20 High Voltage Probe 30, 100, 300, 1,000, 3,000, 10,000, 30,000.
RF Voltage with RF22 high Frequency Probes 0-20 volts R.M.S.
Very solid construction in metal box size: 7 x 4¼ x 3¼ins. Weight 3¼lb.
A real bargain for £19/10/- plus 12½% tax £2/8/9, total **£21/18/9** plus postage.
Extra for R.F. Probe £2/6/6 plus 12½% tax 5/10, total **£2/12/4** plus postage.
Extra for H.V. Probe £3/3/- plus 12½% tax 7/11, total **£3/10/11** plus postage.

★ SPECIALS ★

SPECIALS IN RECORDING TAPE —
This tape, which has proved to be good quality, is available in the following types. It is well packaged and prices are most reasonable.

TYPE NO.	SIZE OF SPOOL	LENGTH OF TAPE	PRICE
PL2	3 inch	200 ft	9 0
AC3	3 inch	300 ft	13 4
PL6	5 inch	600 ft	1 3 4
AC9	5 inch	900 ft	1 11 0
PL12	7 inch	1200 ft	2 3 6
AC18	7 inch	1800 ft	2 18 8

1. Stocks are available of the following Resistors all manufactured to Army or British Navy specifications and all new and guaranteed.

Resistance Ohms	Wattage	Price
36	100	5/
45	100	5/
50	10	1/6
50	20	2/
100	40	3/
120	80	4/
174	85	4/
350	25	2/6
	var. tap	
700	20	2/
850	20	2/
4000	20	2/
5000	20	2/
5000	40	3/
5500	12	1/6

2. Voltage dividers, 15,000 ohms with 2 Variable Taps, **3/9 ea.**

3. 5mm Ignition Cable solid rubber insulation, a really good buy, only **6d yd.**

4. Power Packs as used in Vibrator sets, 6 volts DC input to 130VDC output complete with vibrator and fully filtered. Price only **£2/10/- ea.**

5. **Bargains in electrolytic Condensers:**
16 mfd 525 P.V. 2/6
25 mfd 50 P.V. 1/6
24 mfd 350 P.V. 3/
50 mfd 40 P.V. 1/6
25 mfd 40 P.V. 1/6
10 mfd 40 P.V. 1/

6. **Bargains in Block Condensers:**
4 mfd 1000 Volt Wkg 8/
4mfd 200 Volt Wkg 3/
2 mfd 400 Volt Wkg 2/9
1 mfd 500 Volt Wkg 1/9
3 plus 5mfd 100 volts AC Wkg. 400 volts DC Wkg 3/9
.025 mfd 2000 VDC Wkg Block Mica 3/
.02 mfd 1000 DC Wkg Block Mica 1/9
.01 mfd 200 VDC Wkg Block Mica 2/3
2 x .01 mfd 2000 VDC Wgk. Block Paper 3/
.001 mfd Block Mica for RF work 5/
.00017 mfd 4000 VDC Wkg Block Mica for RF work 5/

7. **10,000 ohms. Carbon Pots 2/ ea.**

8. Shielded Slug Tuned Oscillator coils suit 6A8G, 6J89, ECH35, 6AN7 **33/9**

9. Shielded Slug Tuned RF Coils to match above **3/9**

10. Dynamic Ear Pieces Impedance aprox. 5 ohms ideal for Pillophone or small Speaker **5/**

11. **Filter Chokes:** 1 Henry 300 mA Brand new and packaged, built especially for use in TV Sets. Worth 30/. Our price only **15/ each**

12. Germanium Diodes: English make. A bargain for **3/6 each**

SPECIAL NOTICE

All goods will be sent Passenger Rail unless otherwise stated. Postage or Freight.

547 ELIZABETH STREET, MELBOURNE — Phone FY0271

BRANCHES THROUGHOUT VICTORIA AND RIVERINA

sound films. In practice the results better than many 3¾ inches per sec- tape recordings, possibly due to the ıter efforts shown by designers of ɔe equipment.

rom the point of view of ease of ration, stripe scores again. The sound picture are on the same storage lium, and thus synchronism is auto- ic. Since magnetic recording is used,

This picture shows the contrast ɔetween 35mm sound film with its optical sound track and 8mm ound film with its magnetic stripe track.

sound track may be erased and re- ced at any time at no extra cost.

The sound and picture equipment can ily be combined in one unit, little ger than a normal projector. The unit ıwn in the picture, for instance, has recording and playback amplifier lt in to the base of the projector- ınd head unit, and the complete chine slips into the speaker box for velling and storage.

The cost of a machine using sound pe is usually in the region of £240, ich compares very favourably with t of a good projector and tape re- der combination. Of course, the chine may be used solely as a tape order if 8mm perforated tape is used. e results obtainable from such a unit really all that could be desired.

\TTACHMENT

Slightly poorer results may be obtain- by the use of an attachment fitted a normal 8mm projector. The cost a complete unit of this type is gener- y of the order of £100. Thus quite ɔptable results can be obtained with existing projector at this additional st.

Incidentally, it is only possible to add stripe adaptor easily to a projector ng an asynchronous motor. With pro- tors using series wound (or "univer- " or AC-DC) motors, the speed is not fficiently well regulated as a rule, and ɔcial arrangements must be made. me cases require the inbuilt series ɔtor to be disconnected and an ex- nal asynchronous motor connected.

The cost of film striping (coating the n with the magnetic stripe) works out Australia at about 3d per foot. The process is thus not cheap, but at the same time it is not over expensive.

As can be imagined, the striping pro- cess is a very delicate one, and very close adjustment is required for the small size of stripe used on 8mm film. Dif- ferent brands and batches of film stock require different adjustments for the optimum stripe quality. When a film is sent for striping, best results will be ob- tained if it has a minimum of splices and changes in film stock.

It is thus most desirable to send a film for striping before it is edited— when it is in one long length. An even better system is to stripe the film before it is exposed; this also allows the use of a camera with an inbuilt recording head for on-the-spot recording. A camera of this type has recently been released in America by the Fairchild Corpora- tion.

SUMMING UP

In conclusion, it seems reasonable to say that the best quality results can be obtained by the use of perforated 16mm tape. However, this system is initially rather expensive for amateurs and in practice is rather bulky. The use of a normal tape recorder synchronised to the projector can give quite good sound quality, but the synchronism is rather messy and the system is again bulky and clumsy in operation.

Thus magnetic stripe seems to be the best compromise; it is reasonably inex- pensive, has the advantages of ease of operation and compactness of equip- ment, and is capable of very good re- sults. With it, hire of copies of commer- cial films with pre-recorded sound tracks becomes practical, which is not so with systems that use a separate medium for the sound recording. In fact, moves have been made in England to release a num- ber of 8mm sound copies of various films.

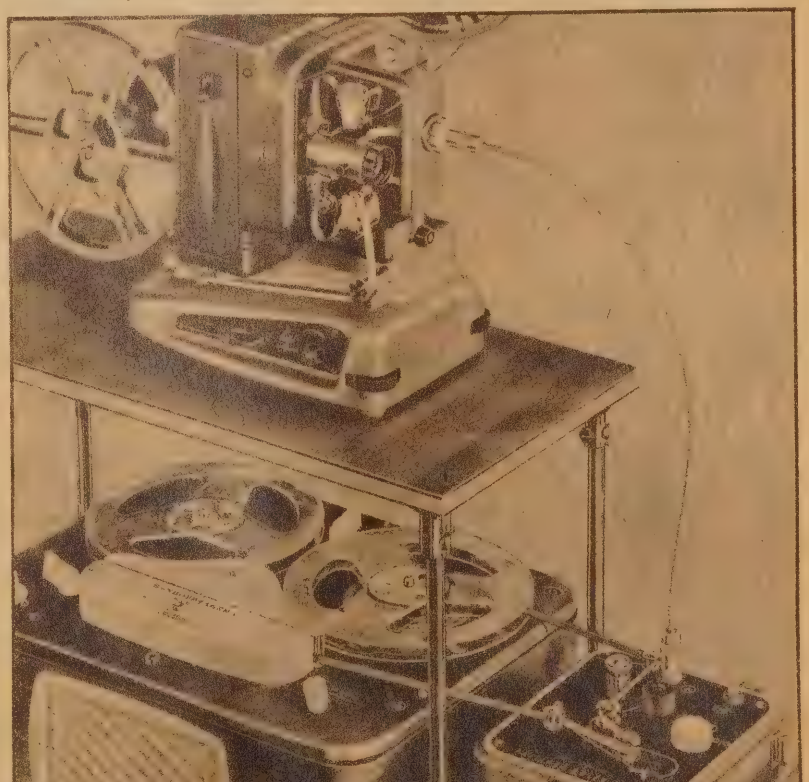
For the person contemplating the pur- chase of an 8mm movie outfit, and who is looking ahead to the time when he will need synchronised sound, two satis- factory courses of action are available at the moment. One is to purchase a complete stripe projector, and thus be able to transfer easily to good quality sound films when he desires.

ALTERNATIVE

The other is to purchase a normal silent projector (preferably one using an asynchronous motor rather than a series wound type) at the present, and add to this a stripe attachment when the addi- tion of sound is desired. The sound quality of the second method is slightly poorer, but the final word in the matter is usually one of financial suitability.

In any case, it is apparent that the 8mm film gauge is no longer unsuitable for sound. With modern developments in the field of magnetic recording in gen- eral, and magnetic stripe in particular, the 8mm film with stripe sound is be- coming very suitable for the amateur filmer.

With new faster-speed film emulsions, smaller grain size, and cameras with in- built transistorised recording amplifiers appearing, this gauge can offer the home user quite as much as its bigger brothers.



The Paillard Bolex synchronising attachment can be used to synchronise many 8mm projectors to a tape recorder. It uses the size of a loop of tape to control the speed of the projector. Here it is shown with the Paillard Bolex M8R projector and a Tandberg tape recorder. (Photo courtesy Steel Kelly & Co., and P.I.A. Pty. Ltd.).

KITSET SPECIALS

BUILD IT YOURSELF...

...FOR HALF PRICE

1. Reinartz (Batt.) 2
2. " (A.C.) 3
3. S/W 3 Band 3
4. Interstate (A.C.) 5
5. Dual Wave " 5
6. " " " 6
7. Portagram "
8. Portaplayer "
9. S/W (Batt.) Converter 1
10. " 2
11. " (A.C.) 1
12. " " 2
13. All/W/C " 1
14. "/C " 2
15. Playmaster (Stereo) Control Unit No. 9
16. Playmaster (Stereo) Control Unit No. 10
17. Playmaster (Mono) Control Unit
18. Playmaster W/R Tuner
19. Playmaster Unit Program Source
20. 50 M/cs Converter
21. 144 "
22. Transistor 1
23. " 2
24. Transistor 3
25. " 4
26. " 5
27. Transporta 6
28. " 7
29. " 8
30. R. T.V. & H. Transistor 8
31. " Dual Wave 8
32. Transistorgram 4
33. Transportagram 7
34. Transistor Stereo Amplifier 1 Watt
35. " 4 "
36. Transistor 10 Watt Amp.
37. Mullard 3-3 Amp.
38. " 5-10 "
39. " 5-20 "
40. Playmaster 17 Watt Stereo Amplifier
41. 21" 110% TV Kit
42. Senior Signal Tracer
43. W/R Audio Oscillator
44. 5" W. Range C.R.O.
45. V.T.V.M.
46. Pattern Gen.
47. Sweep Gen.
48. Electronic Tacho.

POPULAR KITS — AT ATTRACTIVE PRICES

UNIT STEREO Amp. No. 2 £34/12/6	TRANSISTOR STEREO UNIT 4 WATT £29/12/6	13w. GUITAR Amp. £14/12/6	MULLARD 2-2 STEREO £21/15/-
STEREO CONTROL UNIT No. 9 £13/7/6	"TWIN 10" STEREO £36/10/-	25w. P.A. Amp. £22/12/6	HI-FI 3 Amp. £13/17/6
STEREO CONTROL UNIT No. 10 £21/15/-	MULLARD 5-7 STEREO £31/15/-	35w. P.A. Amp. £29/12/6	TRANSPORTA 7 £22/15/-

"8" **"TRANSPORTA 8" KIT** "8"

The addition of an RF stage to the already amazing distance reception of the "Tranporta 7" further extends the range. A terrific performance and kit price is only £26/14/6.

CALL, WRITE, OR PHONE FOR FURTHER INFORMATION ON ANY OF THE ABOVE KITS

In addition to our Standard Kits listed above we also stock all Radio and TV Component Parts such as Valves, Picture Tubes, Condensers, Resistors, Transformers (output & power) Record Players and Changers, Transcription Units, Speakers, Microphones and Accessories, Tape Decks, Transistors and Diodes, Meters and Instrument and Amplifier cases, etc.

DON'T BUY . . . BEFORE YOU GET OUR QUOTE

MAIL ORDERS TO ALL AUSTRALIAN STATES — NEW ZEALAND, AND PACIFIC AREA.

ELECTRONIC DEVELOPMENTS

NICHOLAS BUILDINGS, 37 SWANSTON ST.

Phone 63-5973 MELBOURNE Phone 63-5973

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

ADAPTOR FOR FM RECEPTION ON TV RECEIVERS

Many readers are keen on the idea of using their TV set to receive the experimental FM transmissions in Channel 3, and we have had several inquiries as to whether this is possible. We have tried the idea ourselves on a temporary basis, and good results are possible. However, Mr E. Robertson, of 5 Naree Rd., French's Forest, N.S.W., has produced a more refined version which he describes as follows:

RECENTLY I had an occasion to arrive home from work during the early afternoon and I was surprised to find my wife listening to music on the TV set with the picture tube at full brilliance.

"After inquiries, I ascertained that this was normal practice, the music on the radio she claimed as being suitable only for juveniles.

EARLY GRAVE

"While I appreciated her views, I was not very happy about the picture tube blazing needlessly away to an early grave.

"On the weekend following I fitted a switch to enable the disconnection of the filaments of all the tubes used only for picture reproduction. An increase in high tension followed, so it became necessary to insert a series resistor in the cathode circuit of the rectifier. The switch was arranged to short-circuit this resistor and reconnect the filament during picture reproduction.

"It also occurred to me that an excellent source of music was going to waste in the form of the P.M.G. FM station in the Channel 3 band.

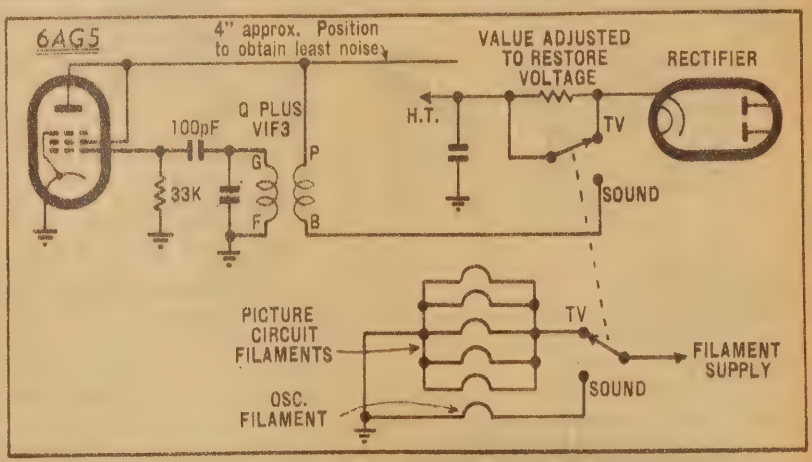
"I constructed a 36 megacycle oscillator consisting of a disposal 6AG5 and a Q Plus VIF3 intermediate transformer tuned by a Philips concentric type trimmer and mounted it underneath the vision IF strip. A circuit is enclosed.

BEST RESULTS

"The scheme worked with the oscillator output not connected to the set, but it was found that best results were obtained by connecting a piece of insulated wire about four inches long to the plate of the oscillator valve and moving it about at random until the best signal to noise ratio was obtained. With the best setting no noise was discernible.

"To tune the oscillator, set the receiver on Channel 3, with the receiver fine tuning control in the mid position. The oscillator trimmer is then adjusted. A series of positions will tune the FM station, but choose the one which gives the strongest injection and, therefore, the strongest signal. This will drive the limiter stage into the limiting condition, making the response appear broader than otherwise."

(Editor's Note: It should be pointed out it is generally considered unwise to switch off a valve heater while HT is applied to the other elements. The decreasing ability of the cathode to release electrons (as it cools) may lead to particles of active material being torn from the cathode. This applies also to the picture tube.



Converting a TV receiver to receive FM transmissions in Channel 3 involves the provision of an artificial video carrier at 36 Mc. In addition, unwanted valve heaters may be disconnected if required.

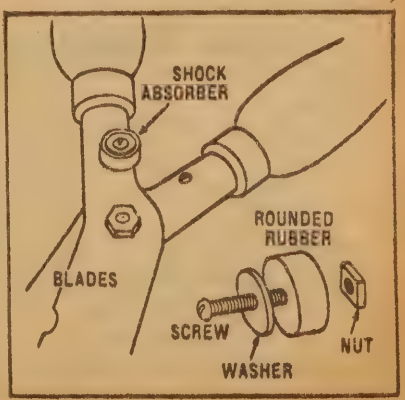
SHOCK ABSORBER FOR SHEARS

WHEN trimming a hedge, the repeated jarring of the wrist and arms as the shear handles are closed can be avoided with the use of rubber shock absorbers.

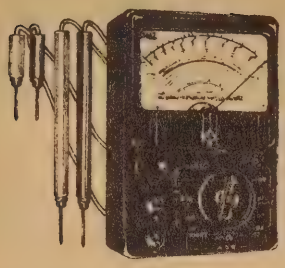
Firstly, it is necessary to drill two holes in each of the blades towards the handle ends, to take suitable sized bolts.

The shock absorbers can be made from two ordinary flat pencil rubbers, rounded off and mounted on the blades with the nuts, bolts and two washers as shown in the diagram.

Tightening the bolts to compress the rubbers will take care of any slight inaccuracy in positioning the two holes.—**(B.S., Tanunda, S.A.).**



FAMOUS SANWA MULTIMETERS for reliable equipment



THE POPULAR SP5

2,000 ohms per volt AC and DC measures—
VOLTS AC/DC: 10v; 50v; 250v; 500v; 1,000v.
AMPS.: 500 micro Amps, 25 mA to 500 mA.
DECIBELS: minus 20db to plus 22db, plus 20db to plus 35db.
RESISTANCE: 10K, 1 Meg.
CAPACITANCE: 0-.03 mfd on 250 Volts AC, 0-5 mfd on 10 Volts AC.
SPECIAL RESISTANCE RANGE: 0-100 Meg. on 250 Volts AC.
Complete with batteries and test leads.

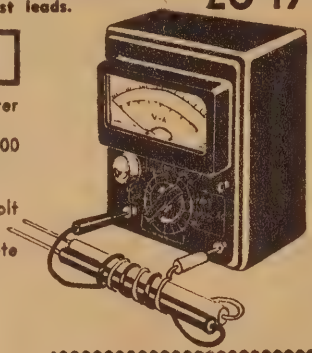
£6/17/6

THE DELUXE 3059

High sensitivity 40 micro Amps full-scale meter measures—
VOLTS 0-10v, 50v, 250v, 500v, 1,000v (AC 8,000 ohms/v) (DC20,000 ohms/v).
AC CURRENT: 0-50 micro Amps 25mA, 250mA.
DECIBELS: 0 to plus 22 (at AC and 10 volt range); 0 to .777 5V—600 ohms.
SPECIAL RANGE: for DC 5,000 volts. Complete with batteries and test leads.

£12/19/6

(Postage for both 7/6)



WALTHAM TRADING Co

229 Elizabeth St., Melb.

Mail Orders please write to nearest branch

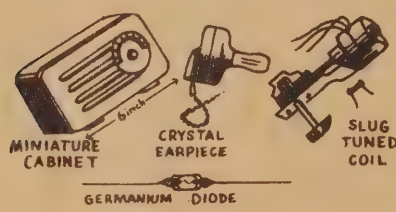
SORRY NO C.O.D.

INTER-COMM. SETS

These will operate over at least half a mile (probably considerably more) and work off 1½ Volt Batteries.

2 BATTERIES ..... 3/6 ea.
2 CARBON MICROPHONES, 7/6 ea.
2 PAIR OF HEADPHONES, 17/6 pr.
HOOK-UP WIRE ..... 6d per yard.
TELEPHONE WIRE, 5/- per 100yds
2 ON and OFF SWITCHES, 3/6 ea.
2 MICROPHONE TRANSFORMERS, ... 4/6 ea.
2 MICROPHONE SOCKETS, 1/11 ea.
(Post 5/- per set)

CRYSTAL SET PARTS



CRYSTAL EARPIECE 10/-
HEADPHONES ..... 27/6 pr.
MINIATURE CABINET 7/6
SLUG TUNED COIL (complete wth knob condenser and circuit) 16/6
GERMANIUM DIODE 3/6
AERIAL WIRE (100 feet) 3/6
TERMINALS ..... 1/- ea.
(Post 1/6 per part, 7/6 per set)

SPECIAL!

BENDIX FREQUENCY METER

221AK, 125 Kcs to 20,000 Kcs AC/DC.

A BARGAIN AT JUST

£45

Delivery to Rail 5/-.

How-to-do-it RADIO BOOKS

No. 126.	The Boys Book on Crystal Sets	3/9
No. 97.	Practical Radio for Beginners Book 1.	4/6
No. 86.	Midget Radio Construction	5/3
No. 106.	Radio Circuits Handbook No. 4.	3/9
No. 150.	Practical Radio Inside and Out.	5/3
No. 133.	Radio Controlled Models	7/6
No. 159.	Realistic Hi-Fi	7/6
No. 163	Transistor Circuits Manual No. 2.	3/9

(Post 1/- per book)

MINIATURE MOTORS

These popular little motors are perfect for powering your model cars and trains, etc. Operate of 3-volt batteries and come in two models.

Model No. 45 .. .. .. 8/6
Model No. 55 .. .. .. 10/6
(Postage 1/6)

RELAY COUNTERS

Standard P.M.G. type call counters. Registers 9,999. Double coil 2-6 volt and 230 volt D.C. Measures 2 inches x 1⅛ inches x 4⅞ inches.

25/-

SWITCHES

for all purposes

4-way Magneto Switch .. 3/6
Two Position Switch 5/6
Toggle Switches (assorted) 4/6 to 8/6
Circuit Breakers (various amperages) 7/6
Micro Switches (assorted types) .. .. 5/6 to 7/6 to £1
ALL THESE PLUS DOZENS OF OTHER TYPES.
(Post 1/6 ea.)

WOBBULATORS

For TV testing frequency modulator construction

(Post 3/-) **50/-**

Volt & Amp Meters

0-100 amp. AC/DC 55/
0-50 amp. AC/DC 55/
0-20 amp. AC/DC 55/
0-30 volt DC 55/
0-50 volt AC/DC 55/
0-250 volt AC/DC 70/
0-300 volt AC 70/
(edgewise) 70/
(Post 2/-)

BRANCHES AT:—

SYDNEY: 463 Pitt Street, 96 Oxford Street.

ADELAIDE: 243 Rundle Street.

SUCCESS OF NEW RADIO TELESCOPE

Following the recent success of the Jodrell Bank radio telescope in tracking and controlling the U.S. Pioneer Five space probe satellite, another "first" may be chalked up to a second British radio telescope, this time at Cambridge. The new telescope differs from the Jodrell Bank type, but can be equally effective in a wide variety of fields.

OBSERVATIONS by the Cambridge telescope have enabled "man to see further than ever before."

The radio telescope fixed the position of a nebula five thousand million light years away which, on the basis of the English observation, has now been photographed by the 200-inch optical telescope at Mount Palomar, U.S.A.

Announcing this in London recently the Mullard Radio-Astronomy Observatory, which is associated with the Cavendish Laboratory, Cambridge, stated "The Nebula, designated 3 C 295, is now the most distant object ever seen in the whole universe." The statement added, "But it is probable that many of the radio stars now being recorded are at an even greater distance."

The newly photographed nebula is said to be receding from earth at close on half the velocity of light.

WORLD'S LARGEST

Mullard's radio telescopes are among the largest in the world. Though less spectacular than the giant paraboloid radio telescopes (like the world's largest at Jodrell Bank) they can equal the power of two Jodrell Bank installations if worked in conjunction with each other.

The Cambridge installation consists of an aerial (itself a series of arcs) 1,450ft long. Behind is another though shorter series of aerials mounted on rails. The second series can be moved back so that together the two sets scan an area of space. The movable telescopes run as far as 1,000ft behind the fixed series.

The telescope gives a map of an area with one of the highest degrees of accuracy possible. Connected with the telescope is a computer which deals with the information received from space. What is now designated as "3 C 295" was first observed on the Cambridge telescope last year and details were published in the Cambridge Survey of Observations, published in August. Cambridge and Mount Palomar have been in correspondence on the observation as part of their regular co-operation ever since and recently Palomar confirmed that it had photographed the nebula.

It may be difficult for most people to grasp the significance of "five thousand million light years," but it is worth noting that, since it has taken that length of time for light and radio waves to reach us from this nebula, it may well be that the nebula itself no longer exists!

AWA

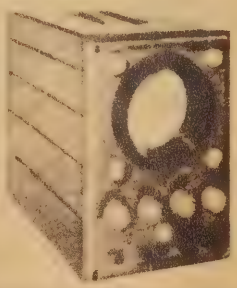
TEST EQUIPMENT for EFFICIENT TV SERVICING

TELEVISION CALIBRATOR TYPE A56057

Frequency range: 19 to 260 Mc.
Crystal frequency: 2.5 and 5.5 Mc.
RF Output: More than 100 mV.
Provision for vertical and horizontal bars.

VOLTOHMYST TYPE A56010

DC volts: 0 to 1500 V.
AC. volts: 0 to 1500V.
Resistance: 0 to 1000M ohms.
DC. current: 0 to 1500 mA.
Accessories available for 30 kV and 250 Mc.

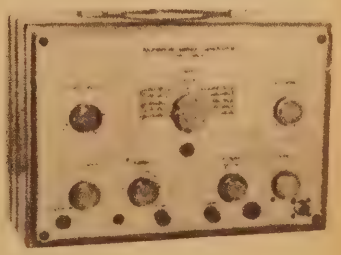


OSCILLOGRAPH TYPE A56031

Frequency range: DC to 1 Mc.
Time-base: 3 cycles to 30 Kc.
Sensitivity: 10 mV RMS/inch.

SWEEP GENERATOR TYPE A56036

RF frequency range: TV channels 1 to 10.
IF frequency range: 500 Kc to 50 Mc.
Sweep width: 0 to 10 Mc.
Provision for Oscillograph time-base and phasing control.



Brisbane and Northern Rivers readers, for further literature write to

CHANDLERS

Cnr. Albert & Charlotte Streets, BRISBANE 31 0341

This transistorised wavemeter-monitor covers from 3.1 Mc. to 200 Mc. Plug-in coils stand on a shelf at the rear of the unit. The two-metre hairpin loop coil is shown in position.

A Transistorised Wavemeter-Monitor

Last month we described a simple transmitter for the two-metre band (144 Mc.). This month we present an easily built wavemeter which will enable you to check the output of each stage of your new transmitter. The addition of a closed circuit jack turns the wavemeter into a handy monitor—required by P.M.G. regulations.

By Keith Jeffcoat (VK2BK) and Vol Molesworth, M.A. (VK2VO)

THE wavemeter will be of interest to amateur radio operators using the lower frequencies as well as those on the VHF bands. It covers from 3.1 Mc to 200 Mc. in four steps, with sufficient overlap to provide continuous tuning. Thus, seven amateur bands are covered —80, 40, 20, 15, 10, five and two metres.

WIDE RANGE

The wide range is achieved by the use of four plug-in coils, three of them wound on fibre formers and mounted in miniature four-pin speaker plugs, the fourth consisting of a hairpin loop of 14 SWG wire. Full winding details are provided for the set of coils.

The wavemeter is constructed from standard radio components available from most trade houses. The average home builder should have no difficulty wiring up the unit to the design illustrated in this article, and, if the coils are wound to the specifications given, calibration of the instrument is simplified.

The prototype wavemeter and its associated coils have been carefully calibrated with laboratory equipment, and a table of the dial-readings is included in this article. If your wavemeter is constructed along the same lines, the dial-readings should be fairly close to those set out in the table.

However, we shall have more to say about calibration later.

The wavemeter itself is constructed according to well-known principles. A glance at the circuit shows that it falls apart naturally into two halves—a crystal detector at left, and a transistor DC amplifier at right to increase sensitivity.

When any of the coils is plugged in it forms a parallel-tuned circuit with a midget variable capacitor. This has a minimum capacity of 4.8 pF and an upward swing of 92.4 pF. When this circuit is tuned to the frequency of a source of RF, it absorbs a small amount of energy.

The current is rectified by a crystal diode, which is by-passed with a .001 mfd disc ceramic capacitor. At this point, the rectified current could be measured by means of a milliammeter.

The sensitivity of such an instrument would, however, be restricted. We could overcome this by using a 100 microamp meter, but this is an expensive item. To increase sensitivity, the current is passed through the base-emitter circuit of an OC71 transistor. An 0-1 mA meter is then connected in the collector circuit of the transistor.

METER SENSITIVITY

The 0-1 mA meter is not chosen simply to cut down the cost of the wavemeter. It actually functions better in this circuit than a more sensitive (and more expensive) meter.

Although the transistor has a DC current amplification factor of about 10, the collector current is not directly proportional to base current. The meter readings will tend rather to follow a "square law" response; that is, the amount of full-scale deflection will be proportional, not to the actual value of RF voltage, but to the square of it.

To obtain a reasonably linear response, it is necessary to decrease the sensitivity of the meter. A meter with a sensitivity of 1,000 ohms per volt makes a good compromise.

High values of current amplification are obtained in the grounded-emitter transistor circuit, i.e., using the base as the input electrode. A small change in base current produces a rather large change in collector current.

To dip into the text-books for a moment, base-to-collector current amplification is known as Beta. In commercial transistors, this has a value many times greater than the familiar emitter-to-collector amplification (Alpha). Beta is equal approximately to Alpha divided by (1—Alpha).

From this relationship it can be seen how a transistor having an Alpha of only 0.909 can give current amplification of 10 in the grounded emitter circuit.

LOW POWER DRAIN

It is also clear that junction transistors having the highest Alphas (approaching 1), also show the highest Betas.

High-Beta performance permits operating the grounded emitter circuit as a DC amplifier with low power drain. The amplifier has a current gain of 10 when

Alpha is 0.909, and can have a gain of 00 when Alpha is very slightly greater han 0.99.

Taking advantage of this gain, a DC illiammeter placed in the collector cir-uit will respond to microamperes ap-lied to the base input circuit.

Fig. 1 shows a simple amplifier type nicroammeter. Input current of 100 nicroamperes will deflect the 0-1 mA neter to full scale. For simplicity, no ero setting circuit is shown. This is he basic circuit of the transistor am-lifier used in our wavemeter.

Fig. 2 shows a simple bridge circuit n which the meter can be placed. Two rms of the bridge are formed by a pair f 1,000-ohm ½-watt resistors. The third rm is provided by the collector-emitter ircuit, and the fourth arm consists of a 0,000 ohm potentiometer.

With no signal applied to the base, the otentiometer is adjusted until the volt-ge drop across it is equal to the volt-ge drop from collector to emitter. The neter is then "zero-set."

ZERO-SET

Some readers may wonder why we ave combined the ON/OFF switch ith the zero-set control. We can as-ure you this was not done merely as a natter of convenience, nor to keep the ront panel uncluttered.

It was realised early that, in a fairly imple piece of equipment of this nature, hich has no compensation in the cir-uit for transistor variation due to tem-erature change, it would be necessary o zero-set the instrument each time it as used. Accordingly, we decided gainst any sort of pre-set zero control.

Our tests showed that a variation of -10 deg. F in temperature caused the neter to rise approximately .1 to .2 nilliamps from the zero position, so do ot be alarmed if you find that the in-trument, which you have carefully cali-rated on the cool side of the shack, uddenly changes its reading when noved to that sunny spot by the win-low!

By combining the ON-OFF switch ith the zero control, we leave you no lternative but to zero-set the meter ach time you switch it on. (Remember, oo, there should be no coil plugged in hen the meter is balanced.)

This switch breaks the current from 1.5 V torch battery, thereby conserv-ng battery life when the wavemeter is ot in use.

A closed circuit jack is placed in eries with the meter. In order to moni-

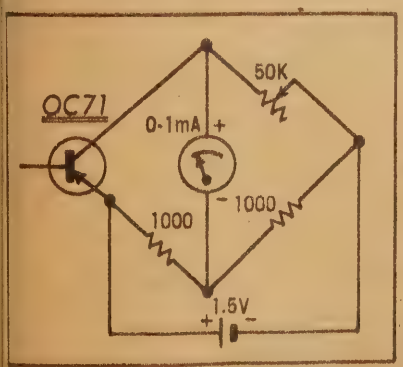
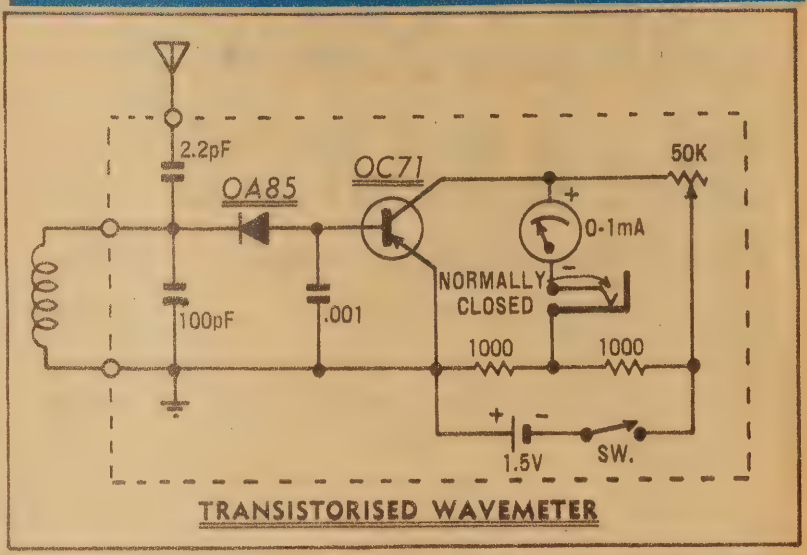


Fig. 2—A simple bridge circuit in which a meter can be placed.

WAVEMETER — MONITOR CIRCUIT



The circuit consists of a crystal detector and a transistor D.C. amplifier to increase the sensitivity of the instrument. A closed-in circuit jack provides a monitoring point.

tor the output of your transmitter, plug in a pair of headphones of low impedance. We got reasonably clear audio reproduction with phones of 50 ohms and of 2,000 ohms. Best reception was obtained with a pair of headphones of 200 ohms impedance.

The versatility of the wave-meter-monitor has been increased by adding an antenna, made up of ten inches of bronze welding rod, plugged into a banana socket on the top of the case.

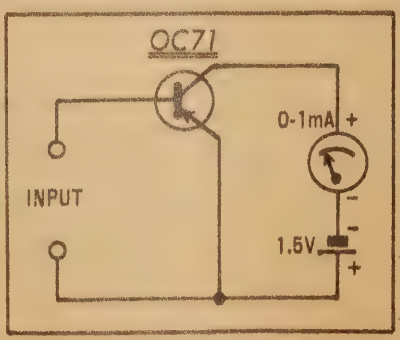


Fig. 1 — A simple amplifier type microammeter.

The plug-in antenna is connected through asmall value capacitor (2.2 pF) to the top of the parallel-tuned circuit. The unit is now converted into a very handy field strength meter, which may be carried out on to the roof to check the radiation pattern of the transmitting aerial.

For VHF field work, it can be put in service as a "sniffer" and used to locate hidden transmitters.

The wavemeter is built in a steel box measuring 7in long, 4in high, and 4in deep. The box has a back plate which is attached by self-tapping screws. Our box was made up for us, with all holes punched out, by a firm which advertises regularly in this magazine.

The physical layout of the unit can be seen in the photographs. The 0-1 mA meter is mounted at left, with the vernier dial at right to balance it. Between them is fitted the "zero set" control knob (at top) and the monitor jack (below it).

The bronze rod antenna plugs into a banana socket on top of the box (at left), while the coils plug into a miniature four-pin speaker socket immediately behind the vernier dial.

Since the box is completely shielded when the backplate is screwed on, the coils must be mounted externally to allow R.F. pick-up.

Looking at the unit from the rear, with the backplate removed, the meter terminals are seen at right, and the tuning capacitor at left. This is a Polar C8-02, which has 12 fixed and 13 moving plates, with an airgap of .015 inches. It is mounted to the front of the box by two countersunk 6BA bolts one inch long. These are passed through spacers to stand the capacitor about three-quarters of an inch back from the panel.

VERNIER DIAL

The dial is a Jabel C2 micro vernier, which has an 8 to 1 reduction drive. The dial drive fits around the shaft of the capacitor, and is fastened by means of a grub screw.

The tuning capacitor is connected to the two wide-spaced pins of the miniature four-pin socket by solid busbar. Use 12-gauge tinned copper wire here, making the connections quite rigid. Unless the internal wiring of the wavemeter is made rigid, the instrument may go out of calibration every time it is bumped!

At the top left can be seen the connection from the fixed plates of the capacitor to the socket. This wire is exactly one inch long. The other lead, from the moving plates to the socket, is exactly 1¼in long.

Stocktaking CLEARANCE

BELOW MANUFACTURING COST!

FERRIS

TRANSFORMER & COILS FOR TV RECEIVERS

Power Transformer for TV, silocondiode voltage doubler, type 329 — (240V; primary; 12.6V C.T.; 6A; 125V; 600 mA).	£4
Filter choke for TV and amplifiers, 300 mA, I.H. Type 817.	16/2
1st Video I.F. with 30.5 Mc/s trap, no can type 943.	11/4
2nd and 3rd Video I.F., no can type 941.	10/9
Video Detector Coil, 7/8in sq. can type 945.	13/1
Sound take off transformer 5.5 Mc/s T206 in 7/8in sq. can.	11/9
Ratio Detector; T102; 1⅜in sq. can.	16/4
Video series choke, L204, 36uH, to improve picture quality.	3/3
Video plate choke L205, 250 uH.	3/10
Spook Suppressor for damper tube L403, 1.5 uH; on resistor blank.	4/9
Horizontal oscillator coils for 6BL8 type 780.	5/-

COMPONENTS

Potentiometers Dual Concentric 1000 ohm over 500,000 ohm with outer spindle 1in and inner spindle 1½in fitted with 250V 10A D.P.S.T. switch.	17/3
Potentiometers D.P.S.T. 500,000 ohm with 1¾in spindle.	7/-
Potentiometers 1 meg. ohm non switch 1½in spindle	3/11
Potentiometers 100,000 ohm plain M93.	3/11
Potentiometers 1 meg. ohm D.P.S.T. with Tongue Spindle M93 and M92.	7/-
Potentiometers 50m ohm plain slotted Spindle M104.	3/11
Condensers Variable 3 Gang with ¾in Spindle.	23/-
Condensers Variable 2 Gang with ⅜in Spindle.	15/11
Condensers Electrolytic 500 mfd 12V P Type ET5D.	4/-
Switches Oak S/S pole, 3 position. Various Spindle lengths from ¾in to 1½in.	7/-
Knobs, Tuning, etc. Brass, Chromed, suit ¼in shafts.	1/8
Knobs, Type MV6—Grey.	1/2
Rings, Speaker 6in with Mesh Grille.	11/10
Housing Speaker 6in under Shelf or Rear Shelf for car radio, etc.	14/8
Connectors fuse flanged complete M.F.	1/9
Connectors—microphone cable M & F complete	15/1
Connectors Amphenol.	1/6
Sockets—valve or vibrator 6-pin with circlip.	1/8
Cloth—suit radio speaker grilles, colour blue.	yd. 12/9
Dials—Hub moulded on brass boss, 2¾in diameter x ⅜in bore.	3/5
Dials—Hub cast gunmetal 2in diameter x ⅜in bore.	2/2
Plugs—4-pin miniature.	11d.
Valves—6H6.	2/-

TRANSFORMERS & CHOKES

Filter Choke 150mA, 200 ohm	£2
Low voltage transformer, 240V primary; 4V; 2A Secondary; C.T. Type 103A	22/10
Low voltage transformer, 240V primary; 8V; 1A Secondary; C.T. Type 104A	22/10
Type 103-6 volt vibrator transformers	22/10
Type 104-12 volt vibrator transformers	22/10

BROADCAST BAND COILS

Aerial coil, 1 3/8in round can. Special High Q	8/-
Aerial coil, ¾in square can, bakelite paper former	6/7
R.F. Coil, 1 3/8in round can. Special High Q	8/5
R.F. Coil, ¾in square miniature can. Polystyrene former	7/-
R.F. Coil, ¾in square miniature can, bakelite paper former	6/7
Oscillator coil in 1 3/8in round can	6/10
Miniature oscillator coils in ¾in sq. can for 6AN7, 6A8 or 1R5 Valves	4/8
Miniature oscillator coils in ¾in square can for 6BE6 valve	3/3
I.F. Transformer for 455 kc/s in 1 3/8in round can. Special High Q	9/9
I.F. Transformer for 455 kc/s in ¾in square can, Universal, type 119	9/1

CABINETS SUITABLE FOR TV OR SPEAKER UNITS (FEW LEFT)

Beautifully polished Walnut veneer 17in Console	£6/10/-
21in Console	£11
21in Consolette	£6/10/-

HI-FI EQUIPMENT

Low pass Filter units for connection in speaker voice coil leads. Fully engineered L.C. circuit having ideal response to sharp cut off frequencies of 6 Kc or 8 Kc controlled by a 3-position switch. **£5/15/-**

POWER SUPPLIES

Fully encased, 240V input 300V 150mA fully filtered D.C. out, three filament windings 6.3 and 5V Complete with 5Y46 Rectifier **£8/15/-**

Push Pull output Transformers, well-known make. Flat reponse 60 cps-10 kc, Impedance primary 10,000 ohm. Secondary 16 or 8 ohm. **£4/16/2**

VOLTAGE STABILIZER

Brand new Sola Chicago. 200-260V. 50 cps input; 220-230 Volt controlled output 300 VA. Ideal for TV or measuring equipment.

£21/14/- each plus 12½ p.c. Sales Tax if applicable.
Freight extra.

AND MANY OTHER TV COILS AVAILABLE FROM STOCK.

NOTE: Prices include postage or freight and Sales Tax.
No extra to pay.

SEND CHEQUE OR MONEY ORDER OR INSPECT AT FACTORY

FERRIS BROS. PTY. LTD.

752 Pittwater Road, Brookvale, N.S.W. **Telephone XF0221**

These lengths are critical. Do not make either of these leads any shorter or longer than we have, or your calibration of the wavemeter will be affected on the highest band.

The .001 mfd disc ceramic capacitor is wired from the right hand side of the socket to a spare pin, which is used as a tie-point. From the tie-point, the OA85 diode is wired to the fixed plates.

Now we come to the transistor itself. This could be wired directly in by its leads, but we decided to use a standard miniature hearing-aid valve socket. We doctored the socket to accommodate our transistor.

We removed pins number 2 and 4 from the socket with a pair of long-nosed pliers, leaving the other three pins in the socket double-spaced. The centre pin of the socket takes the base lead from the transistor, and is wired to the tie-point.

The top of the hearing aid socket takes the collector lead and is joined by hook-up wire to the fixed arm of the potentiometer and also to the positive terminal of the meter.

The bottom of the hearing aid socket takes the emitter lead from the transistor, and goes to ground at the earthy pin of the coil socket.

In wiring the transistor, remember that the collector element is marked by a red dot. The use of a socket has the very great advantage that the leads of the transistor do not need to be soldered, and, in the process, possibly damaged.

CARE IN SOLDERING

If no socket is available, take very great care in soldering in the transistor. Grasp each lead with a pair of long-nosed pliers and apply heat sparingly. (These remarks also apply to the OA85 diode.)

The two 1,000 ohm resistors in the bridge are wired from what would normally be the earthy side of the phone jack, one going to the moving arms of the capacitor, the other to the moving arm of the potentiometer, and to one of the switch terminals on the back of this pot.

In this circuit, neither side of the phone jack is earthed. The jack must be insulated from the metal case by two fibre washers. The "hot" end of the jack goes to the negative terminal of the meter.

The base of the battery is soldered straight on to the other switch terminal on the back of the potentiometer, its positive terminal being grounded at the moving arms of the tuning capacitor.

The "earthy" side of the circuit is then connected to the metal box by means of a short piece of copper wire.

The only connection left to make is the 2.2 pF disc ceramic capacitor. One pigtail is soldered to the fixed plates, the other to a length of tinned busbar which goes to the antenna input jack.

To give the wavemeter a professional appearance, we sprayed the box with quick drying grey enamel.

As mentioned at the outset, three of the coils are wound on fibre formers and fitted into miniature 4-pin speaker plugs, with the screwcaps removed. The fourth is a hairpin loop which plugs directly into the socket.

The first coil, which covers from 3.1 Mc to 10.3 Mc, is wound on a three-quarters inch diameter former. It consists of 46½ turns of 26 SWG enamel covered wire, close wound.

The next two coils are both wound on 7/16in formers. Coil No. 2, which covers from 9.7 Mc to 33.2 Mc, consists of 21 turns of 21 SWG, close-wound. Coil No. 3, which covers from 27 Mc to 95 Mc, consists of 4½ turns of 18 SWG, also close wound.

HAIRPIN LOOP

The ends of each of these coils are cleaned and slipped through the wide-spaced pins of their plugs. They are then drawn tight, soldered into place, and any extraneous wire snipped off.

The coils are then given a coating of melted hard wax or pitch which holds them in place and also protects them from moisture.

Coil No. 4, which covers from 51 Mc to 200 Mc, consists of a piece of 14 SWG enamel covered wire, exactly 3½in long, bent into a hairpin loop to fit into the wide-spaced pins of the socket. The ends are cleaned for half an inch and tinned to make good electrical connection.

We drilled holes into a strip of mica to make a "stand" for the coils. The stand may be attached to the rear of the boxtop by means of spacers.

When the wavemeter has been constructed, and each of the coils wound, the next step is to check the calibration of the instrument.

CHECK METHODS

One method would be to use an accurate RF oscillator, in the unmodulated position. Another method would be to use several crystals whose fundamental and harmonic output frequencies are known, in a simple oscillator circuit.

A third method would be to check the coils for resonance (plugged into the unit so that the tuning capacitor is across them) with an accurate grid dip oscillator.

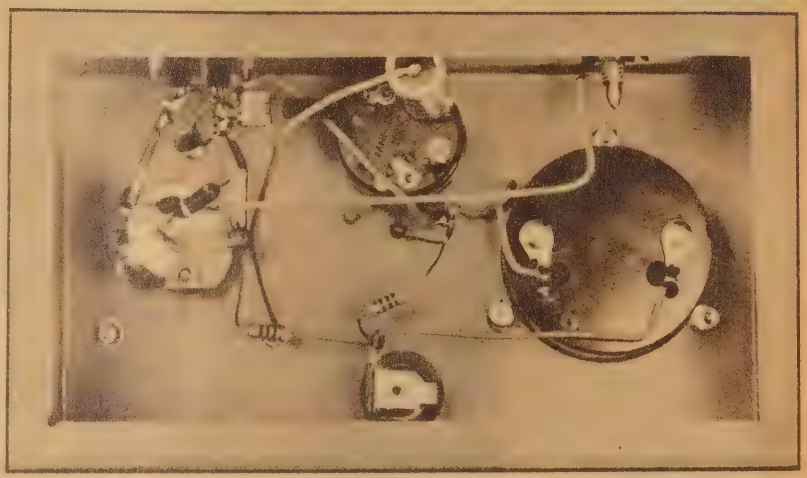
Do not despair, however, if none of these avenues is open to you. If the coils are wound exactly to our specifications, and if the two leads from the tuning condenser to the socket are the same length as ours, the dial readings you get will be very close indeed to those listed in the table.

You are now ready to put your wavemeter to work on your 2-metre transmitter. You will remember from last month's article that RF output should be present at three frequencies — 24 Mc, 72 Mc and 144 Mc. The exact frequencies will depend on the fundamental frequency of your crystal. (Ours was 8013.5 Kcs.)

Having switched the transmitter on and allowed it to warm up, plug in coil No. 2 and tune the dial around 14 for an indication of RF output around 24 Mc from the plate of the harmonic oscillator.

To facilitate pick-up, take a piece of hook-up wire about 24in long. Solder one end into a banana plug and plug it into the antenna socket of the wave-

REAR VIEW SHOWS ALL WIRING



The 100 pF variable condenser is seen at left, and the 50,000 ohm switch pot centre, with the monitoring jack below it. The O-1 mA meter is at right. The transistor can be seen in its socket top left.

PARTS LIST

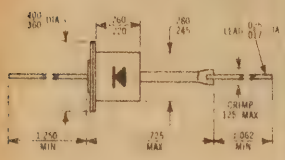
- 1 Steel box, measuring 7in x 4in x 4in with backplate (type MW 1).
- 1 O-1 mA meter
- 1 Variable capacitor (see text).
- 1 Vernier dial (see text).
- 1 OA85 diode.
- 1 OC71 transistor.
- 1 2.2 pF disc ceramic condenser.
- 1 .001 mfd disc ceramic condenser
- 2 1,000 ohm ½-watt resistors.
- 1 50,000 ohm switch potentiometer
- 1 1.5 volt battery.
- 1 Banana socket.
- 2 Banana plugs.
- 1 4-pin miniature speaker socket.
- 3 4-pin miniature plugs.
- 2 7/16in coil formers.
- 1 ¾in coil former.
- 1 Closed circuit jack.
- 1 Length of bronze welding rod (10in.).
- 1 Small knob.
- 1 Hearing aid valve socket.

★ The WARBURTON FRANKI Page ★

WORLD'S FINEST SILICON ZENER VOLTAGE REGULATOR DIODES

BY THE FAMED INTERNATIONAL RECTIFIER CORP., U.S.A

1 WATT RATED TYPES



All dimensions in inches

Ratings and Characteristics at 25°C Ambient

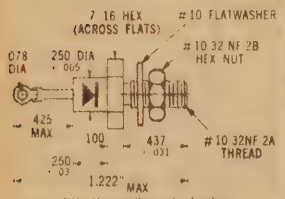
JETEC TYPE	INT'L TYPE	ZENER VOLTAGE RANGE VOLTS	@ Iz ma.	TYPICAL DYNAMIC RESISTANCE Zz (OHMS)	Iz MAX.	NOMINAL TEMP. COEFFICIENT %/°C
1N1518	1Z 3.9	3.6-4.3	50	9	250	.04
1N1519	1Z 4.7	4.3-5.1	40	8.5	200	0
1N1520	1Z 5.6	5.1-6.2	35	5.5	175	+.03
1N1521	1Z 6.8	6.2-7.5	30	1.6	150	+.05
1N1522	1Z 8.2	7.5-9.1	25	1.1	120	+.06
1N1523	1Z 10	9.1-11	20	1.5	100	+.07
1N1524	1Z 12	11-13	15	2.4	80	+.075
1N1525	1Z 15	13-16	13	5.4	65	+.08
1N1526	1Z 18	16-20	10	11	55	+.085
1N1527	1Z 22	20-24	9	18	45	+.09
1N1528	1Z 27	24-30	7	28	35	+.095

CLOSE TOLERANCE TYPES AVAILABLE 5%, 10% and 20% AS LISTED BY THE STANDARD RETMA DECADE SYSTEM

★

ALL STANDARD TYPES AS LISTED AVAILABLE FROM STOCK

3.5 WATT RATED TYPES

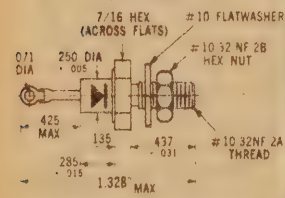


All dimensions in inches

RATINGS AND TYPICAL CHARACTERISTICS

JETEC TYPE	INT'L TYPE	ZENER VOLTAGE RANGE VOLTS	@ Iz ma.	TYPICAL DYNAMIC RESISTANCE Zz (OHMS)	Iz MAX.	NOMINAL TEMP. COEFFICIENT %/°C
1N1588	3Z 3.9	3.6-4.3	150	2.6	850	-.04
1N1589	3Z 4.7	4.3-5.1	125	2.3	700	0
1N1590	3Z 5.6	5.1-6.2	110	1.4	625	+.03
1N1591	3Z 6.8	6.2-7.6	100	.58	525	+.05
1N1592	3Z 8.2	7.5-9.1	80	.5	425	+.06
1N1593	3Z 10	9.1-11	70	.7	350	+.07
1N1594	3Z 12	11-13	50	1.4	275	+.075
1N1595	3Z 15	13-16	40	3.4	225	+.08
1N1596	3Z 18	16-20	35	6	200	+.085
1N1597	3Z 22	20-24	30	9	160	+.09
1N1598	3Z 27	24-30	25	13	125	+.095

10 WATT RATED TYPES



All dimensions in inches

RATINGS AND TYPICAL CHARACTERISTICS

JETEC TYPE	INT'L TYPE	ZENER VOLTAGE RANGE VOLTS	@ Iz ma.	TYPICAL DYNAMIC RESISTANCE Zz (OHMS)	Iz MAX.	NOMINAL TEMP. COEFFICIENT %/°C
1N1599	10Z 3.9	3.6-4.3	500	.84	2500	-.04
1N1600	10Z 4.7	4.3-5.1	400	.68	2000	0
1N1601	10Z 5.6	5.1-6.2	350	.3	1750	+.03
1N1602	10Z 6.8	6.2-7.5	300	.2	1500	+.05
1N1603	10Z 8.2	7.5-9.1	250	.25	1200	+.06
1N1604	10Z 10	9.1-11	200	.55	1000	+.07
1N1605	10Z 12	11-13	170	.95	850	+.075
1N1606	10Z 15	13-16	140	1.5	660	+.08
1N1607	10Z 18	16-20	110	2	550	+.085
1N1608	10Z 22	20-24	90	3	450	+.09
1N1609	10Z 27	24-30	70	4.5	350	+.095

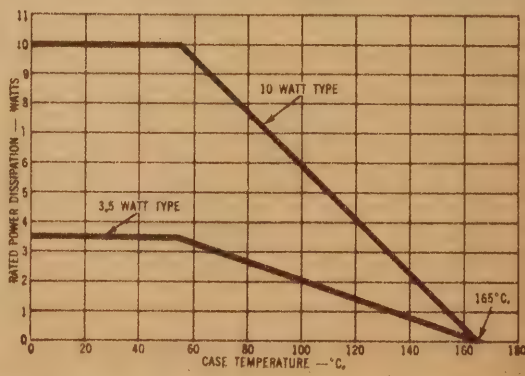
★

SPECIAL TOLERANCE TYPES ARE AVAILABLE TO ORDER IN 5%, 10% AND 20% TOLERANCE

- STUD MOUNTING
- EXTREMELY LOW DYNAMIC RESISTANCE
- OPERATING TEMP. TO 165°C (Case).
- WIDE RANGE OF POWER RATINGS
- ALL-WELDED, HERMETICALLY-SEALED CONSTRUCTION

Designed for pigtail mounting and chassis mounting or cooling fin for high power dissipation, these silicon zener diodes are extremely stable and rugged voltage regulator devices. They have been developed and process-selected to provide exceptionally low dynamic resistance and sharp zener characteristics over the entire operating current range.

Derating of Power Dissipation vs. Case Temperature 3.5 watt and 10 watt Series.



WARBURTON FRANKI

VIC.—355 LONSDALE ST., MELB., 67-8351 ● N.S.W.—307 KENT ST., SYDNEY, BX1111.
QLD.—233 ELIZABETH ST., BRISBANE, 31-2081.

ORIGINAL CALIBRATION DATA

Coil No. 1		Coil No. 2		Coil No. 3		Coil No. 4	
Dial	Mc.	Dial	Mc.	Dial	Mc.	Dial	Mc.
0	10.3	0	33.2	0	95.0	0	200
5	10.0	8	30.0	6	90.0	12	150
8	9.5	10	28.0	8	85.0	13	144
9	9.0	13	25.0	10	80.0	14	140
10	8.5	16	23.0	12	75.0	15	135
12	8.0	19	21.0	14	70.0	16	130
14	7.5	22	20.0	16	65.0	17.5	125
15.5	7.2	24	19.0	19	60.0	18	120
17	7.0	27	18.0	23	55.0	23	110
20	6.5	30	17.0	29	50.0	26	100
24	6.0	34	16.0	34	45.0	32	90
29	5.5	40	15.0	45	40.0	40	80
35	5.0	42.5	14.5	59	35.0	52	70
44	4.5	46	14.0	81	30.0	72	60
57	4.0	54	13.0	87	29.0	82	56
64	3.8	64	12.0	94	28.0	85	55
67.5	3.7	76	11.0	100	27.0	87	54
72	3.6	93	10.0			90	53
77	3.5	100	9.7			95	52
100	3.1					100	51

Although each instrument should, ideally, be calibrated against the best available standard, the above figures should be reasonably accurate if the original layout is used with identical components.

eter. Wind several turns at the other d around your forefinger. This makes pick-up loop which may be dangled ose to the plate coil of the harmonic cillator valve.

The degree of coupling between the ate coil and the pick-up loop will affect e reading on the wavemeter.

If no reading is obtainable at 24 Mc, ug in coil No. 1 and tune around 12 sce if the crystal is operating, on its Mc. fundamental. If a reading is pre- nt here, this condition can be correct- by varying the value of one of the o capacitors in the harmonic oscillator cuit, as discussed last month.

When maximum output is obtained 24 Mc., plug in coil No. 3 and tune ound 13 for indication of RF output 72 Mc.

Coil No. 4 is used to detect output the final frequency of 144 Mc. Do t get too close to the tank coil with pick-up loop or you will bang the edls of the wavemeter hard over.

The transmitter may now be tuned for best performance by tuning each ge and watching the wavemeter for dication of maximum output. If the eter reads full-scale even with the link removed, tune slightly off frequency to protect the movement.

Now plug the headphones into the monitor jack, whistle into the micro- phone of the modulator, and you will hear your own transmission in the moni- tor.

The wavemeter is also very useful for trimming the parasitic elements of a Yagi. With the beam pointed towards the wavemeter, and the transmitter on, a certain reading will appear on 144 Mc.

The elements of the beam are then trimmed for maximum RF.

The instrument we have described can be made 10 times more sensitive by the addition of a second OC71 transistor. The circuit for this modification is given in Fig. 3.

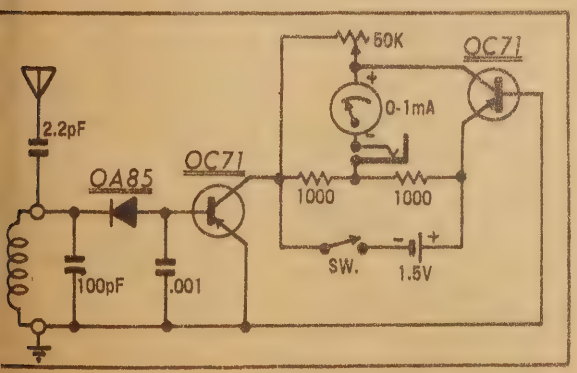


Fig. 3 — Modified circuit using an additional transistor for improved sensitivity. It gives a gain of approximately 10 times, making the instrument extremely valuable for antenna radiation measurements and similar applications.

2ND STAGE

The additional transistor, which can be another OC71, is wired in as a common-emitter amplifier stage, added in cascade for 10 microamp operation of the meter. Note that in the circuit drawing the second transistor has been turned around so that current flows through its base in the correct direction to increase the collector current. The collector current of the first transistor, which originally operated the meter, now flows directly through the base-emitter input circuit of the second transistor, so that no load resistors are required, and we have no problems of interstage impedance matching.

The meter and its associated zeroing circuit, which is the same as before, is now placed in the collector circuit of the second transistor.

Since we have a D.C. current amplification factor of 10 in each transistor, the new circuit gives us an overall gain of 100, thereby increasing the sensitivity of the meter from 100 microamps to 10 microamps. This is an easy way of making yourself a really sensitive instrument, and at far less than the cost of a 10 microamp meter.

USEFUL IMPROVEMENT

The increased sensitivity will enable measurements of antenna radiation to be taken at much greater distances from the antenna. It will also enable measurements to be made, with much looser coupling, of transmitter circuits which contain small amounts of R.F.

We suggest that, for a start, the wavemeter-monitor be built up with just one transistor, and that the various tests described be carried out. In all probability, you will find that the instrument will be sufficiently sensitive for most of the experiments you wish to perform. If, however, you find that increased sensitivity is desirable, the second transistor can be wired in within a few minutes.

Whichever version you end up with, the transistorised wavemeter-monitor will be a handy instrument in the shack, and will serve a very useful purpose in getting your new two-metre transmitter and modulator on the air.

POWER SUPPLIES

Type X

Input 0-240 AC.
Output 1200V DC at 500 mA.
217V DC at 300 mA.
7V DC at 20 amp.

Brand New £19/17/6
Plus Freight.

3BZ Transmitter and Receivers

Complete with speaker, microphone and leads. 12 volt DC.
Suit small ships.
£42/10/- Air Tested
Plus Freight.

Relay Panels

Containing: 12 relays, 20 phone jacks, 240-24 volt 3 amp transformer, 5 pots, 2 micro switches, relay rectifiers, octal sockets, resistors, condensers, etc.
£4/10/- Plus Freight

PARAGON RADIO

479 Parramatta Rd., Leichhardt. LM9402. Top Taverners Hill.

A.C.E. RADIO

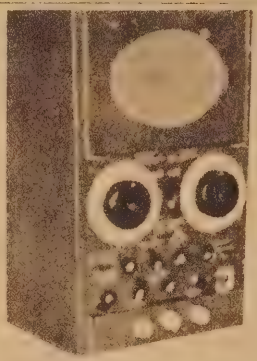
PHONE LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

AND 636 KING STREET, NEWTOWN — LA7008

EVENINGS and WEEKENDS: "KALUA," Hilma Street, Collaroy Plateau, XW595

DULWICH HILL, UNDERCLIFFE, EARLWOOD BUS AT DOOR, STOP No. 42



AR8 Communications Receivers

12 valve. Converted to 240v A.C. Thoroughly Tested. Re-aligned. Latest Ovaltone Permag Speaker

£34/17/6

NEW VALVES

12C8	12/6	1629	10/
VT501	12/6	1619	£1
211	17/6	RK75	10/
1C6	12/6	VR75/30	15/
1J6	12/6	RK48A	£3
3A4	15/	954	7/6
3B7	10/	VR105/30	15/
3D6	10/	6AC7	5/
304TH	£1/10/	EL3NG	12/6
6AM5	15/6	2X2-879	5/
6AM6	17/6	6AJ5	9/6
1K7	5/-	VR150/30	15/
1M5	5/	6AK5	17/6
6X4	12/6	9006	5/
6J5	9/6	6AS7	12/6
9003	12/6	6A8	17/6
6J6	15/	CK1013	15/
6J7G	7/6	6SA7	15/
6N7	10/	6SL7	15/
KTW62/6U7	7/6	6AB7	12/6
1D5	7/-	EF39	12/6
6F6	12/6	EK32	15/
EF37	12/6	EBC33	12/6
6X5	10/	809	9/6
6V6	12/6	100TH	12/6
12K8	12/6	7F7	12/6
1T4	10/	EL91	10/
1P5	7/6	EF73	10/
803	£1/5/	EF72	10/
VT502	12/6	EC70	10/
1L4	5/	V90/30	15/
6K6	7/6	1F5	7/6
AV11	3/9	2A3	10/
6K7	5/	807	£1/-/-
12SJ7	12/6	6L6	£1/-/-
12SL7	12/6	2C26	7/6
6SH7	7/6	RK34	7/6
47	12/6	1N5	7/6
843	£1/10/	1C7	2/6
957	10/6	1Q5	5/
1625	£1	1M5	5/

Navigation Compass

5-inch. Spirit filled.

£1/15/-

Postage 5/.

NEW C.R.O. TUBES

2API	£1/2/6
3API-906	£1/7/6
5BPI	£1/17/6
CV1957	9/6
CV112	10/
VCR138	17/6
5LPI	£2/17/6
VCR97	£1/17/6
5FP7	17/6
3FP7	7/6
5EP7	7/6
CV322	7/6
VCR511B	£1/7/6

NEW POWER TRANSFORMERS

240v A.C. 50 cycle primaries. Standard 6.3 filaments.

300 x 300v 40mA	19/6
300 x 300v 60mA	£1/2/6
320 x 320v 80mA	£1/9/6
385 x 385v 100mA	£1/7/6
385 x 385v 150mA	£1/17/6
325 x 325v 150mA	£3/17/6
250 x 250v 180mA	£3/17/6
295 x 295 300mA TV	£6/15/
115v 700mA TV	£4/17/6
750 x 750v 750mA	£7/10/
240v to 6v or 12v 1 amp	12/6

Vibrator Power Transformers

6V 135V 35mA	£0 19 6
6V 300V 125mA	£3 17 6
12V 325V 125mA	£3 17 6

Inverter Transformers

6V 240V 40 Watt	£3 7 6
12V 240V 60 Watt	£3 7 6
32V 240V 60 Watt	£3 7 6
12V 240V 100 Watt	£4 5 0
32V 240V 100 Watt	£4 5 0

RELAYS

6V, 3-pole Miniature	15/
1700 SPDT	7/6
1300 SPDT	7/6
500 x 500 SPDT	7/6
12 volts DPDT. 5 amp	£1
12 volts DPDT	12/6
11 volts A.C.	£1
Hi-speed Polarised relay	£2/10/
400 ohm	12/6
6v. Type 3000	7/6

Hi-lo Phono Transformers	4/6
Canadian Signal Lamps	7/6
Hi-voltage. Lead-thru Insulators each: 15/ doz.	1/6
Hydrometers, Battery Testers	5/9
Multi-strand 4-core Cable, yard	1/
100 yards	£2/17/6
60pf with Vernier	£1/1/
30 pf	10/
Throat mikes, new	3/6

OIL FILLED CONDENSERS

.5mfd 600V	3/6
2mfd 600V	6/6
1mfd 600V	6/6
4mfd 4000V	35/
4mfd 600V	6/6

TRANSFORMERS

240v-110v. 1,000 watt Projector Transformers.

£8-10-0

GENEMOTORS

Input	Output			
24v.	250v. 100mA	£1	0	0
24v.	550v. 375mA	£2	0	0
24v.	250v. 60mA	£1	5	0
12v.	500v. 350mA	£8	10	0
12v.	1200v. 200mA	£6	10	0
24v.	250v. 100mA. New	£2	0	0
12v.	235v. 50mA	£2	15	0
12v.	350v. 50mA	£2	15	0
24v.	540v. 200mA. New	£2	15	0
24v.	300v. 205mA. New	£2	15	0
12v.	275v. 110mA	£3	15	0

NEW V.H.F. WAVE METERS

A.C. Powered. 240v-50 cycle. 5 valve.
Calibrated 155-220 megs.
Overlap covers 144 meg.
Also suitable Hi Bands TV.

£4/17/6

TELEPHONES TYPE F MAGNETO

Table Model.
Long Range — Tested.
Perfect Order.

£3/19/6

Cable to suit, new, 1-mile. drums, £1/7/6

V.H.F. TRANSMITTING VALVES

New. Current. Not war-time manufacture.
832A-QQ/04/15

19/6

4/125A—4D21—QY3/125

£4/15/- EA.

NEW BUTTERFLY CONDENSERS

30PF.

7/6 (Post 1/-)

New Coils and Intermediates

Standard or miniature to suit all valves

Coils B/C. 455 KC	9/6
Coils S/W. 455 KC	9/6
Inters	11/6
Loop aerial coils	9/6
Slug tuned H.F. coils to suit 44 meg.	4/6

GENE MOTOR SPECIAL

12v. 300v. 250 M.A.
Will operate TV Sets.

£1/7/6

NEW TRANSMITTER POWER SUPPLIES

240v. 50c.
1200v. 500mA. 275v. 200mA.
613v. 9 amp. Fully Filtered 2 x 866 Rect. and Selenium Rect.

£19/17/6

WANTED

Communications Receivers. Test equipment. P.A. Gear. Large or Small surplus stock. Best prices. Call, write or phone any time.

DYNAMIC HEADPHONES

Low impedance **17/6**

Postage 2/6.

Dynamic microphones, type 7, 12/6
Postage 2/.

No. 19 TRANSCEIVERS

Complete with 15 valves and power supply.

£12/17/6

P.A. SPEAKER UNITS

P.A.7. New condition

£7/10/- EA.

With short aluminium Horn and Line Transformer.

£8/10/-

ARR2 RECEIVERS

12v Operation. 11 Valves. 3-6AK5 7-9001 12-A6
V.H.F 234-259 Megs.
Plus 6 Channels. Broadcast and double conversion.
New condition.
Including Valves and Circuit.

£7/17/6

NEW ROTARY CONVERTERS

160 watt. 50 Cycle.
24v to 32v input.
Output can be supplied for 50-110 or 240v as required.
Suit radiograms, TV, tape recorders, fluorescent lights.

£19/17/6

240V A.C.

TYPE S POWER SUPPLIES

As used for AR8-AT5 Stations
575V 350mA plus 250V, 100mA
Plus 12V DC 10amp. Tested
New Condition

£18/17/6

WIREK MAGNAPHON TAPE RECORDERS

Reporter Model.
Battery Powered.
Tested. Good Order.
Complete with Crystal Microphone.

£27/10/-

522 TRANSCEIVERS

Complete with Valves.
Excellent Condition.

£12/10/-

522 Receivers. Complete with Valves **£5/17/**

522 Transmitters. Complete with Valves **£7/15/**

LIGHTING PLANTS

12v. 300 watt.
Direct coupled to 1 h.p. petrol engine.
Tested. Perfect order.

£36/10/-

115v D.C. 2½ amp.
As above. New.
£29/10/.

AIRCRAFT GENERATORS

28V. 100AMP. £12/17/6.
28V. 60AMP. £10/10/-.

1154 TRANSMITTERS

100 watt output.
Complete with Valves and meter
£5/17/6

AT5 TRANSMITTERS

Complete with Valves. £5/17/6

AMERICAN WALKY-TALKY

TYPE 536-611
Complete with valves, crystals and coils.

£6/17/6

ACE RADIO

PHONE LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

636 KING STREET NEWTOWN—LA7008

AMPLIFIERS

Public Address Range
240v-AC

6 Valve, 10 watt, £14/17/6
6 Valve, 25 watt, £25/7/6
6 Valve, 40 watt, £32/7/6
7 Valve, 20 watt, £22/17/6
100-watt £63

Battery Operation

6 valve, 6v, 10 w. £18/15/
7 valve, 12v. 12 watt, £19/15/
7 valve, 12v. 25 watt, £24/17/6

BATTERY—AC OPERATION

6 valve 6 x 240 10 watt, £20/15/.
7 valve 12 x 240 12 watt, £21/15/
7 valve 12 x 240 25 watt, £29/7/6

EXTENDED FREQUENCY

240V-A.C.
20 watts Output.
7 Miniature Valves.

Built-in Multi Match output Transformer. Specially suitable for music systems, guitar and where wide-range reproduction is required.

£23/17/6

R.T.V. & H. 1959 KITSET

21-inch, 110 degree.
Complete Kitset,
£99
Wired and tested, £110.

SEND FOR 1960 BROCHURE ON TV, STEREO AND AMPLIFIERS.

TRANSPORTA 7 KITSET

Complete Kit. and Cabinet.
£24/10/-
Wired and Tested £3 extra.

1960 Model with R.F. STAGE

Using Drift Type Transistors. Improved Range and Performance.
Kitset £25/17/6
Wired and tested, £29/7/6

TV ANTENNAE

A Complete Range from
£4/15/-

RECORDING TAPE

Hi-coercivity tape, ex A.B.C. Stations
1,200 spools £1/7/6
600ft spools 19/6

D.C. TO 240V A.C. INVERTERS

6V Input 40 watts.
12V Input 60 watts.
32V Input 60 watts.
£9/17/6

6V Input, 60 watts, 50 cycles
12V Input, 100 watts, 50 cycles. Suitable for Radiograms, Tape Recorders.
£16/17/6

NEW TEST EQUIPMENT

3in Oscilloscope £37/10/
5in Oscilloscope £47/10/
V. Tube Voltmeter ... £29/10/
Multimeter 20,000 O.P.V. £11/15/
Multimeter 2,000 O.P.V. £5/19/6
Sweep Generator TV IF £30
Sweep Generator, IF and sound £36
Sweep and Marker Generator 2 meg. to 270 meg.,
£79
Details on application.

TAPE RECORDER

7-valve, Built-in Tuner. Input for Microphone. Pick-up Radio. Outputs for extra speaker. Also To High Impedance for P.A. use. Response 60 to 10,000 cycles.

Complete with Tape And Crystal Microphone. **£65**

SINGLE UNIT
STEREO AMP.
7 valve. 7 watt.

2 8WR Speakers. Bass and treble boost, Dual push-pull output. Silicon rectifiers. Complete in cabinet. **£37/10/0**

TV KITSET

23-inch, 110 degree. Latest. Flat, square front.

VISTAVISION

Fringe area tuner. Side tuning. **£110** **Latest framegrid valves.**

Wired and Tested, £12 extra.

CHANNEL ENGLISH TEST UNITS

TRANSISTOR POWERED

RESISTANCE CAPACITY BRIDGE

4 ranges, 2 p.c. accuracy.
10PF to 10MFD.
10 plus ohm to 10 meg.
Small, light, efficient.
£17 Postage 2/.

SIGNAL GENERATOR

4 Band.
120 K.C. to 20 Megs.
on fundamentals.
Excellent harmonic output for TV Marker Generator.
£18
Post 2/.

STEREOGRAM CHASSIS

Dual Wave with R.F. Stage.
8 VALVE, 6BA6, 6AN7, 6N8, EM80, 12AT7, 6BM8, 6BM8, 5Y3.
2 Rola 8MX Speakers.
£38/15/-

10 VALVE, 6BA6, 6AN7, 6N8, 12AT7, EM80, 2 x EF86, 2 x EL84, 5V4.
2 Rola 8MX Speakers.
£49/15/-

Send for full details on Radiogram Chassis, TV and Amplifiers.

15 VALVE, 2 x 6BA6, 6AN7, 6AV6, 6BR5, 2 x EF86, 12AT7, 2 x 12AX7, 4 x EL84, 5AS4.
4 Jensen Speakers.
£66/15/-

STEREO 4-SPEED PLAYERS, £10/17/6

PRODIS SWEEP GENERATOR UNITS

VU.. TV IF. Band
£7 Net.
VSUI. IF. and SOUND.
£14

PORTABLE STEREOGRAM

2 toned. Plastic covered Cabinet.
4 speed. Stereo player.
2 Speakers. 6 watt output.
£32/17/6
With built-in tuner. £7 extra.

BATTERY CHARGERS

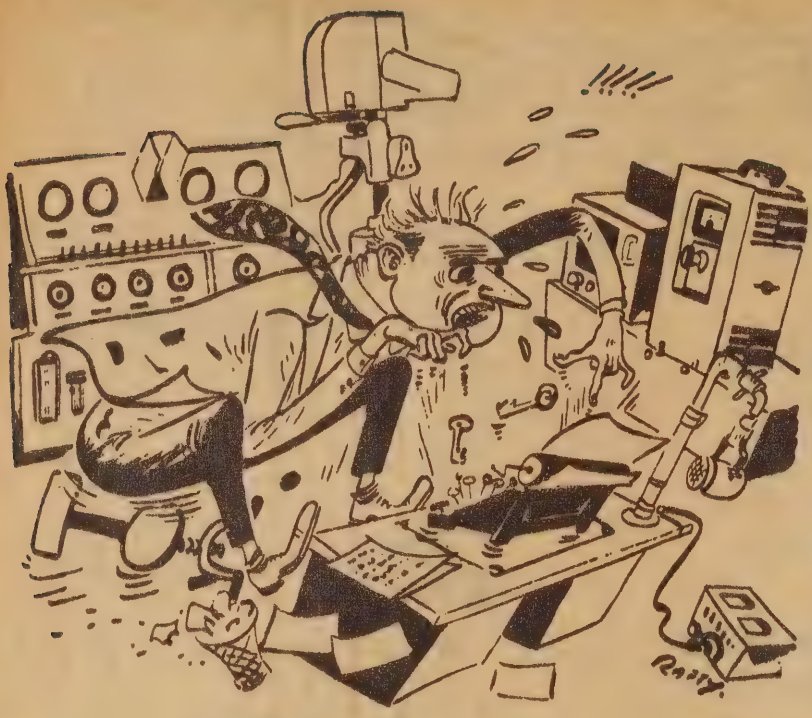
To charge 6 and 12-volt. 3 amp.
£5/15/-
6 and 12v. 4 amp.
£6/15/-
Other Ratings To Order.

AUDIO OSCILLATOR £16/15/-

6 Band 15 Cycle to 500 K.C.

Accurately calibrated. Output 5 volt.
Engraved scale. 240V. AC powered.
Square wave output extra £2/15/-.

A MUST ON ALL SERVICE BENCHES.



Let's Buy An Argument

Transistors may be revolutionary and intriguing but one country reader is not convinced by these newfangled gadgets. To judge by his letter, opposite, he's determined to remain faithful to the valves which have served him, man and boy, for thirty years.

by Neville Williams

FRANKLY, I'm not vitally interested in promoting an argument about the relative merits of valves and transistors. Each have their place in the scheme of things and their relative attractiveness, in the technical sense, varies according to steps in their individual development —and will probably continue to do so

However, I tip that our correspondent's letter is a reaction to the tendency, in some quarters, to discount valves completely and to assert that everything valves can do, transistors can (or will) do better.

OPPOSITE VIEW

Our correspondent's experience to date has simply not supported this idea, particularly in respect to the performance of domestic battery type receivers. Hence his expressed objections. However, in voicing these objections, I feel he is himself guilty of overstatement.

Let's try to take an impartial look at his comments and see where we get.

First of all, however, I must draw attention to his reference to transistors as "tiny tubes."

It is sometimes helpful to draw an analogy between tubes (let's call them valves) and transistors but it isn't wise to push the process too far.

We must clearly recognise that transistors are not just a special version of a thermionic valve. They operate on completely different principles, have completely different electrical characteristics and involve different circuit principles.

Any resemblance between transistor and valve circuits stems not from a similarity of the devices themselves but from the fact that both are capable of signal amplification and both have separate control and output electrodes.

Now for an examination of the points raised by our correspondent:—

(1) SOLDERING PROBLEM: Transistors do need special care in solde but so also do modern miniature c citors and resistors, miniature v sockets and light-gauge plastic-cov hook-up wire.

To build equipment with the ab a few years ago, using the techni and the soldering irons then preva would have been very difficult ind

Nowadays, with smaller irons improved techniques, the use of m ture components presents no sp problem and much the same orde care will suffice for transistors.

In fact, where the leads are left un as for small audio applications, t is probably less hazard with transis than with some of the miniature wi components we use with them.

NOT THE POINT

Of course, one could proceed t discussion of the pros and cons of mi ture components but that is not the p of the argument. The simple fact is the trend is towards smaller and smaller components, and transistors an essential part of the picture.

(2) TEMPERATURE SENSITIVI Transistors are more temperature se tive than valves and this is a defi disadvantage. It is most unwise to fina the design of any item of transi equipment without considering how will behave when taken from mode ambient room temperatures into situ tions where a much higher temperatu prevails.

Depending on circumstances, t equipment may operate poorly in su a situation or not at all, or it m suffer actual damage.

PROBLEM SOLVED

Fortunately, however, such matters not have to be left to chance and c cuit techniques have been develop which compensate for variations in tra sistor characteristics fairly effective over the range of temperatures commo ly encountered.

To be sure, these measures comp cate the design and the final circuit, b they are not by any means prohibitiv as indicated by the finished product.

At the same time, it would be bett if such measures were not needed at one of the areas for active transistor r search is the problem of rendering tra sistors less sensitive to temperature.

(3) BATTERY SUPPLY: Our corr spondent's statement looks very much lik an attempt to turn a virtue into a vice

One of the outstanding advantages

ansistors is their economy in terms of perating voltage and current. Not only as this meant far more economical battery" receivers, but it has opened up host of possibilities in terms of other attery-operated portable equipment, hich was just not practical when only alves were available.

But transistor equipment can be oper-ted from the power mains where there xists the need to do so. As much as nything, the difficulties of so doing rise from the fact that our ideas and omponents for a generation have been irected to producing high voltage at low urrent, as for valves.

ROGRESS

Low voltage at high current calls for new approach but we are getting there, s evidenced by such things as high apacitance electrolytics, rectifiers with ow forward resistance, zener diodes, etc.

Because of present design problems, it t often easier to use valves and conven-onal techniques for fixed installations, here size, heat dissipation, and operat-ng economy are of no special conse-uence.

But, in computers and other complex quipment, where all of the above prob-ms arise from using large numbers of alves, transistors have an important ad-antage, far outweighing any complica-ons of supplying them from the power ains.

(4) POLARITY VITAL: The supply oltage must not be reversed to transis-ors because, in most circuit positions, damaging current will flow.

Though this can, doubtless, be counted s a disadvantage, precautions against happening are normally taken.

Where the equipment is operated from dry" batteries, the polarised plug-and-ocket connectors normally make reverse onnection impossible—or at least un-kely.

Where free leads and clips are used, s for operation from accumulators, it is sual to include a silicon diode in the quipment, in series with one supply ead. The diode constitutes a virtual pen circuit for an applied voltage of ie wrong polarity.

OUBTFUL FEATURE

(5) TONE CONTROL: There is no ood technical reason why transistor re-eivers should not have a tone control. It is commonly omitted from baby ansistor portables for mainly physical easons—there isn't anywhere to put it.

Another point is that baby sets rely or their "loudness" on sound energy in ie middle and upper register. Attenuate ie treble response with a tone control nd there wouldn't be much left.

But these are problems related to nall size, small speakers and low power utput. They are not basically related to ansistors.

(6) TRANSISTOR LEADS: Most lated to the general question of minia-risation. See paragraph (1).

(7) COUNTRY RECEPTION: Most the transistor battery portables to date ave been designed for casual use ound the home and for outings, etc. o special effort has been made to dupli-ate the "DX" qualities of domestic

HE DOESN'T LIKE TRANSISTORS

Are those transistors really so tough? I've discovered that these tiny tubes have many disadvantages!

(1) Transistors may only be soldered with special care.

(2) They cannot cope with high temperature.

(3) Their use is limited to batteries or batteries activated by 240V AC.

(4) Polarity must be noted carefully or the transistors may be ruined.

(5) Transistor sets have no tone control, thus reducing quality of sound.

(6) Transistors need "decent" wires instead of microscopic hair-like wires, which are annoyingly brittle.

(7) Country reception from transistor sets is very limited in terms of range, selectivity, quality of tone and being unable to work under extreme conditions of temperature compared with valves.

(a) Transistors are irreparably damaged if subjected to excessive voltage; valves are not.

(b) Transistors may only be tested with expensive equipment; valves are tested by simple and cheap equipment by amateurs.

(c) Wrong polarity does not ruin a valve.

(d) In many cases valves are cheaper than transistors.

(e) Valves also may work as well from batteries as from AC.

(f) Smallness? Perhaps not so small when one reviews the latest progress in an American magazine, in which one sees the "latest" transistor almost the size of an "acorn tube" such as a 955.

(g) A great electronic field being opened up? I believe only in size!

For amateurs, manufacturers should include instructions for the proper use of transistors!

valve type receivers using an RF stage, special aerial coil and separate aerial and earth.

Comparison may, therefore, convey a false impression of transistor capabilities.

It is quite certain, however, that designers will constantly strive for improved DX performance. Their task is being made easier by the release of better transistors and, in particular, by types suitable for use in RF stages.

We can therefore expect to see more efficient portables and possibly specialised countryman's receivers similar to our own effort in the July issue. There is no special reason why the gain, selectivity and noise factor should not be comparable with valve-type battery-powered receivers.

AS GOOD OR BETTER

As far as audio systems are concerned, adequate frequency response and low distortion can be achieved in transistor amplifiers, given suitable design. In addition, transistors have a big advantage in terms of power output for a given battery drain, so that the overall performance should be markedly better.

Against this, it must be admitted that a high-performance transistor set would involve more stages than a valve set, being therefore more complex and costly.

Where our correspondent sets out to compare transistors and valves, further comment is called for.

(a) EXCESS VOLTAGE: Transistors and valves can both be damaged irreparably by excess voltage, as anyone will appreciate who has burned out a valve filament.

In fact, in valve receivers, voltage sufficient to burn out the filament is often available from the B-battery. In the case of a transistor set, there is no need to have voltage anywhere near it in excess of the maximum for the types involved.

(b) TEST EQUIPMENT: Complex equipment is necessary to test fully either valves or transistors.

In both cases, however, simple equipment can be used to perform elementary "good-bad" tests. (See our last issue).

(c) POLARITY: See earlier remarks regarding polarity.

(d) PRICE: To date valves have had a price advantage but this is diminishing and the position may easily reverse as production quantities continue to increase.

But don't overlook the question of running costs which, even now, far outweigh the higher first cost of transistors.

(e) MAINS OPERATION: See earlier remarks but the further statement here is not realistic.

Valves which are suitable for battery operation are not easy to use on AC mains. Valves which are easy to use on mains are unsuitable for battery operation.

As stated earlier, transistors can be powered from the mains but the running cost from batteries is often so low that it isn't worthwhile. In fact, it is often claimed that the cost of battery power for a transistor portable is less than the mains power for conventional mantel receiver.

(f) PHYSICAL SIZE: Some transistors are indeed as large as "acorn" valves but these are power transistors, with very generous ratings.

SMALLER AND SMALLER

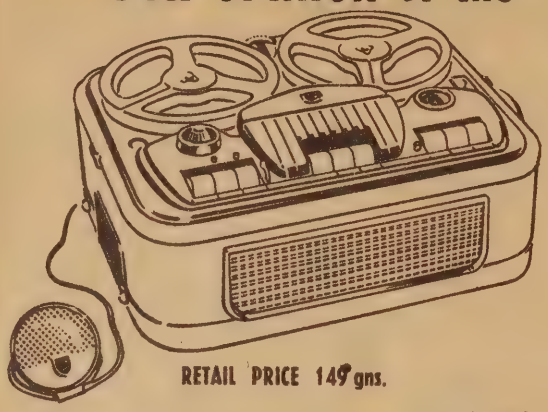
At the other extreme, transistors are being developed more akin to the size of a letter on this page. They are being located in tiny wafer-like sub-assemblies containing the capacitors, resistors and wiring for complete stages.

(g) NEW FIELD: Size alone is sufficient to open up a new field, so why the query? Economy of drain is another good reason, as evidenced by the success of solar power supplies in earth satellites.

And what about the elimination of filament and warm up time, which finds transistors instantly ready to handle incoming signals?

CONCLUSION: Such then are my

OUR OPINION of the PHILIPS TAPE RECORDER MODEL EL 3542 A



RETAIL PRICE 149 gns.

4 TRACK . . . 3 SPEED . . . PUSH BUTTON

We know many different types of tape recorders and although we realise that the Philips doesn't equal a professional machine costing £400, we think it goes very close.

In fact, the American Philips (Norelco) is accepted as having better specifications (and meeting them) than some professional machines.

In our opinion, the Philips, as value for money, is beyond compare.

The Philips EL 3542A is now available on terms and with our usual trade-in allowances from our trade supply showrooms.

SPECIFICATIONS:—

Tape Speeds 1⅞ i.p.s. 3¾ i.p.s. 7½ i.p.s.
Freq. Ranges 50-7000 c/s 50-15,000 c/s 50-20000 c/s
Playing time (long play tape) 12 hours 6 hours 3 hours
Playing time (double play tape) 16 hours 8 hours 4 hours
Wow and Flutter: Less than .3 per cent (peak to peak)
Signal to Noise Ratio: Better than 54 db

ENCEL ELECTRONICS

354 and 361 BRIDGE ROAD, RICHMOND VIC.
JB2820.

EQUIPMENT TROLLEY

"PAYNECO"

"It's a wonderful trolley Sir."

C.R.O. & SQUARE WAVE GEN. BY SOLARTRON

SAVES TIME & COSTLY ACCIDENTS

Rubber surfaced table tilts 30°
Adjustable Depth, 14"-23"
Hammertone & Chrome Finish
3½" Insulated Castors
Max Load—2 cwts.
Top 19" W., 26" H., 26" L.
Bottom 19" W., 21" L.

RONALD J. T. PAYNE PTY. LTD.
385 BRIDGE ROAD, RICHMOND, VIC. JB 1416

QLD. H. MARTIN, Wilson House, Charlotte St., Brisbane. B 1785-6.

W.A. SALES PTY. LTD. 1142 Hay St., Perth. BA 9781

omments on our correspondent's argu- ıent about valves versus transistors. 'erhaps it is rather pointless argument ut I wonder how many other readers ıave been entertaining similar ideas?

One major aspect has not been men- ioned, namely the fact that no transis- ors have been developed to date to ork at the high power levels and the igh frequencies found in transmitting quipment.

A notable milestone will have been ırned when the first all-transistor high- owered transmitter takes the air.

By way of a change from the forego- ng, I have to hand a long list of semi- rgumentative questions from a reader in oburg, Victoria. Space and time do ot permit a full and complete answer o them all, but the following selection ıay be of interest to other readers.

LEGAL POSITION

What exactly is the legal case for the ARTS and P label on a radio? Who gets the money and for what? Is it a racket?

If one wanted to examine in any de- ail the legality of the label in question, t would have to be done on a legal lane—not via a question to a technical nagazine. And, considering the time nd money which could be involved, one vould not institute such an inquiry with- ut having a definite objective in view.

Broadly, the position is that a huge umber of patents has been issued in ecent times relative to "radio." Origin- ting from countries all over the world, hey cover all manner of things. The ights are owned by thousands of com- anies and individuals, but distributed by greement and association to thousands nore.

Some are vital patents; many more ary from unimportant to not worth he paper on which they are written. ome may have lapsed; others may be vide open to challenge, and so on, as vith patents of any kind.

It would be extremely uneconomic nd unsatisfactory if every firm had to police" the use of its own patents by very other firm. It would equally be ifficult to avoid infringement of patents wned by others—with a constant threat f court action if they didn't.

PATENTS POOL

To overcome this difficult situation, ıajor patent holders in Australia pool heir rights through ARTS and P (Aus- ralian Radio Technical Services and 'atents Company).

This company collects a fee covering ll patent rights at a flat rate, by issuing umbered stickers. These are attached o the rear of all "radio" apparatus hich comes within their jurisdiction.

A formula is adopted whereby the alue or cost of the sticker increases in roportion to the complexity of the cir- uit.

The money so collected is ultimately istributed to the patent holders, in suit- ble proportion to the number of patents eld.

It is generally accepted that all rele- ant apparatus constructed for commer- ial use should carry the appropriate RTS and P label and that attachment f the label covers the manufacturer gainst action for infringement of patent.

It is usually considered, further, that home constructors building equipment for purely private or experimental use, need not attach a label to it. However, the obligation to do so follows, if the equipment is sold or put to commercial use.

That, broadly, is the position as we understand it and that may be as much as you want to know. In other words, it is not a "racket" but rather a means of dealing with a very complex situation.

However, if you want official information for business reasons, the proper course would be to get in touch with the ARTS and P Company and/or consult a gentleman who deals professionally in "wherefores" and "hereinafters."

I noticed a statement that "complete modulation of a transmitter reduces heterodyne interference at distant points." What is this all about?

It is likely that the original reference had to do with operation on the amateur bands.

Heterodyne interference occurs when two or more radio frequency carriers reach the detector of a receiver, with a difference in frequency falling within the range reproduced by the audio system.

In case this isn't too clear, imagine that two signals are being received, one at 14,100 Kc. and the other at 14,103 Kc. On reaching the detector, these two signals (or their IF resultants), would beat together or "heterodyne" to produce a steady 3 Kc. whistle from the loudspeaker.

USUAL CONDITION

Because of the crowded conditions on some of the amateur bands, heterodyne interference between two or more stations is the rule rather than the exception. It is quite usual to have to "copy" voice transmissions through a background of heterodyne whistles.

If the modulation level of the desired transmission is low, then the voice signal recovered by the detector is low in proportion. In advancing the gain control to produce sufficient volume, the level of the whistle is increased and the signal made more difficult to follow.

Conversely, a deeply modulated transmission ensures better voice recovery at the receiver detector. The ratio of voice level to whistle level is improved so that, in effect, heterodyne interference is diminished.

Further to this, special circuits can be included in transmitters to allow an artifically boosted amount of speech energy to be imposed on the carrier without overmodulation effects. This can increase "readability" considerably under interference conditions.

You make the statement "cheap resistors may be all right up to a couple of hundred thousand ohms but, above that, nothing but the best."

Does this apply today? Why? What are "cheap" resistors and how on earth does one distinguish them?

BROAD STATEMENT

The statement you question is obviously the kind one makes in an effort to convey a broad impression without getting bogged down in a lot of wordy detail.

The basic facts are that ordinary carbon resistors are given to some drift in value, varying with make, age and the physical treatment they have received.

In general, the percentage drift or risk of breakdown is greater in high values, particularly where the circuit application requires them to carry direct current.

A further fact is that constructors often try to save money by using re- istors from their "junk box," or re- claimed from other gear or bought off a bargain counter. In this sense they are "cheap" resistors of unknown history and with plenty of opportunity to have changed in value.

Since the higher values are the ones likely to have changed most, one should be cautious about using them. Perhaps,

(Continued on Page 127)

VACUUM MOUNTED CRYSTALS

for general communication frequencies in the range 3-14 M.C. Higher frequencies can be supplied.

5.5 KCS. TV Sweep Generator Crystals £3/12/6 + 12½% sales tax.

100 KCS. & 1000 KCS. Frequencies Standard Crystals £8/10/- each + 12½% sales tax.

The following fishing craft frequencies are available in F.T. 243 holders: 6280, 4095, 4535, 2760, 2524, 2182, 4620, etc.

Immediate delivery available for all above types.

AMATEUR TYPE CRYSTALS 3.5 and 7 MC BAND

Commercials—from £3/12/6 each plus 12½% sales tax.

Amateur—from £3/-/- each plus 12½% sales tax.

Regrinds £1/10/-

Crystals for Taxi and Bush Fire Sets also Available

We would be happy to advise and quote.

New Zealand Representatives:—Messrs Carrel & Carrel, Box 2102, Auckland

"Contractors to Federal and State Government Departments"

BRIGHT STAR RADIO

46 Eastgate St., Oakleigh, S.E. 12, Vic. 57-6387

OFF THE RECORD — NEWS & REVIEWS

Last month a correspondent raised the question of tape hiss. Apart from remarking that it was not peculiar to stereo records, I passed it over for later discussion, mainly because I felt that it warranted more than a mere passing mention.

by Neville Williams

AS most readers will realise, recording companies have long since abandoned the practice of taking the original copy directly on a wax or acetate disc, for immediate processing. While conferring some technical advantage, the method suffered the very real hazard that an otherwise good recording could very easily be ruined by a single error.

Since there was no way of deleting the error, a completely new "take" was necessary, with no guarantee that it would not suffer a similar fate.

While serious enough with 78 r.p.m. records, the hazard assumed intolerable proportions with microgroove discs, with playing times extending to a half-hour per side. Some more flexible process was essential.

REQUIREMENTS DIFFER

It may be argued that live performances exceed this time, anyway, but the position is not the same. An error during a live performance is regrettable, but it passes immediately into history. An error in a recording is repeated on each playing and becomes the more obvious because one tends to listen for it.

For many years, virtually all original recordings have been made on tape. This allows faulty sections or numbers to be replaced, so that the master tape, for transfer to disc, should ideally be above reproach, both technically and in terms of the recorded material.

Further, because the timing and dynamic range of the material can be measured, the level on to disc, groove spacing and such like can be preset for optimum results. The advantages are obvious.

In fact, the noise and distortion content of a good tape master can be so low that, for all practical purposes, its interpolation makes no difference to the disc, as heard. This much is evident from the fact that those discs which we may look upon as "near perfect" examples of the art have reached us via a tape link—without any apparent noise or distortion.

POOR EXAMPLES

Unfortunately, there are many discs of which just the reverse is true; noise level and/or distortion level may be high and, while the fault may well have to do with the disc processing, there are equally many other cases where it is attributable to the tape medium.

It is usually not difficult to distinguish between noise which is inherent in the pressing and that which was present on the original material from which the disc was cut.

Noise from the disc itself may be due to several possible factors. These have to do with the cutting stylus or its relevant adjustments; with the material in the master disc; with the plating processes which ultimately produce the stamper; with the presses and the ma erials from which the final copy is mad

Depending on the cause, "disc" noi may vary from a sustained fryi sound to individual clicks, and be an thing from very obvious to very fai It may extend over the entire leng of the groove or may occur on patch of the surface, being discovered by ea successive rotation of the disc.

When noise is a function of the pr gram source, it is usually heard on along those sections of the groove whi carry recorded items.

Thus, the first two or three groov may be substantially silent; then su denly a hiss is heard, followed a spl second later by the start of the iter Between each successive item and ne the conclusion of the record, the hiss di appears and the only noise heard—if an —is that inherent in the pressing.

CAUSES

The effect of the noise appearing an disappearing may be due to manipul tion of the gain control of the recordin amplifier, or to the insertion of pieces blank, noise-free tape before, betwee and after the recorded items.

This "program hiss" may vary fro barely audible to a level which renders disc quite unacceptable for use on wid range equipment. On poorer equipmer it may not be so objectionable becaus limited high-frequency response render it less apparent.

By the same token, it will yield t the use of a treble cut control but at th expense of a corresponding loss of treb information.

Background hiss is undesirable in an case but, when interrupted, it can hav a shattering effect on the cohesion o say, a sacred cantata, where individua items, though separate, are really par of a composite whole.

In talks with local recording engineers I raised the question as to whether an injustice was possibly not being don in the common practice of referring t the noise as "tape hiss."

Could it not be, in some cases, his in microphone channels, and particularly where portable equipment was involved as for recording in churches, auditor iums and theatres?

DOUBTFUL

Was it not true that studio perform ances seemed to suffer less, on th average, having been recorded on perma nently installed equipment?

In fact, I found little support for thi suggestion. The general opinion seeme to be that, portable or not, microphone and microphone channels likely to b used for serious commercial recordin would be above reproach, as far a "amplifier hiss" was concerned.

Likewise, the link between the tap playback and the record cutter.

METHOD OF PHASING SPEAKERS

Dear Sir,

The discussion in "Off the Record" and the letter by K.F.W. (June, "R., TV and H.") on stereo phasing prompt me to make my contribution.

As my radiogram in the lounge, and the kitchen mantel set both have 6V6 outputs and are conveniently situated, I decided to try stereo before going to the expense or trouble of building an integrated amplifier.

The result was encouraging and, as the lounge has cupboards about 30in square either side of an open fireplace 4ft wide, I mounted matched 12in speakers in the centre of ¼in tempered Masonite doors. This gives very satisfying results. I find that the best effect is obtained by swinging the doors in a little, about 20 degrees. The speakers are 8ft 4in apart.

The point which I wish to contribute is in the matter of phasing. I play a monaural record and kneel in front of the centre of the fireplace.

If the speakers are correctly phased the sound appears to come from the fireplace or even from up the chimney, but if they are out of phase I just hear each speaker with the ear nearest—two entirely separate sets of sound.

This is, to my way of thinking, the easiest and best test for correct phasing, and I am of the opinion that the so called "hole in the middle" is frequently a case of speakers out of phase.

Yours faithfully, H.A., Ringwood, Vic.

No, it was basically a tape problem nd one that was a very definite source embarrassment.

To be optimum, for use as a master, pe should be of good quality initially, nused or little used; it should be perated with the correct amount of high equency bias and recorded at the ghest possible average level, consistent ith distortion limits.

This last apparently poses a particular roblem in cases where the dynamic nge of the sound source is very great. nless some peak limitation is applied, ie average recording level may be mainined too low and too close to the oise level of the tape.

When adequate gain is applied subquently, along with dynamic compreson, to accommodate the signal to a isc, the signal/noise ratio is found to e inadequate and the problem of hiss rises.

COMMERCIAL PRESSURE

It may well be that recording engieers in such cases would dearly like to have another go" but the cost and diffiulties of repeat sessions, plus the rgency of production demands the elease of second-rate material.

Another—and I fear more frequent—ause of trouble arises from the ease ith which tapes can be "dubbed" or opied, and from the complex world xchange of titles.

Company A makes a master tape, which may or may not be a prime xample of recording. It has an arrangeent with companies B and C elsewhere, o sends them a copy for their own use.

But B and C, in turn, supply copies f their copies to D and E for use in till other countries, with a further rise n distortion and a further reduction in ignal/noise ratio.

The end result can be rather woeful. As one recording engineer expressed it: "It is one thing to cut a clean disc rom an original tape; it is quite another o cut one from a dub of a dub of a lub."

As I mentioned at the outset, the problem can—and does—occur with mono discs. Many times, during the past ew months, I have had cause to menion the tape hiss on individual records.

It seems that the position can only e more acute with stereo both by reason of the narrower tracks on the tape master, and the fact that the separate channels can each project their own separate background into the listening room.

To be sure, better types and better techniques may allow the difference to be made up, but I fear that many records will continue to be offered for sale, not because they are good, but because somebody will buy them—hiss notwithstanding.

RECORDING LEVEL

One other aspect of present-day recording is overdue for an "airing." It applies particularly to mono 45 r.p.m. discs, but there is plenty of evidence of other discs being affected.

I refer to the matter of recording level.

At first glance, the problem appears to be one for automatic self-determination.

Optimum recording level is a compromise between many conflicting factors. In general, however, too high a level involves a loss of playing time or a loss of quality or both. Too low a level may allow record noise to intrude and find the amplifier lacking sufficient gain. In between is the happy medium.

One would naturally expect recording engineers to recognise this "happy medium" and thus avoid either of the extreme conditions mentioned. Any variations between discs, as far as level is concerned, would be simply compensated during replay by suitable adjustment of the volume control.

But this appears to be an over-simplification of the position.

In practice, a large proportion of popular discs are played under the following conditions:—

(1) In juke boxes, along with other hits of the day, and at a level determined by a pre-set volume control. If the groove modulation is heavy, the record sounds "good and loud"; if the modulation is lower the record isn't heard so well by comparison, and the "customer" is disappointed in it.

(2) Over-budget-conscious radio stations where the "disc jockey" is much more concerned with the announcement to follow than the record on the turntable. And the panel operator, who should be watching the level indicator, is busy sweeping the floor or cleaning windows along with his other duties.

If the groove modulation is heavy, the record sounds "good and loud" . . . etc.

IN THE HOME

(3) On domestic autochangers, where a stack of records is left to play while members of the household go about their various duties.

If the groove modulation is heavy, ... etc.

(4) On cheap valve and transistor players, where design economy has limited gain to the point where it is barely sufficient to produce full output.

If the groove modulation is heavy, . . . etc.

I gather that factors (1), (2) and (4) are considered quite important overseas and particularly in the U.S.

Far be it from me to suggest that they could apply in Australia.

But the end result is that recording engineers are under constant pressure, if not direction, by the sales departments, to achieve a little more level than the opposition and thus gain a "loudness" advantage.

What if the quality does suffer in the process? The record is still playable, isn't it, on an ordinary radiogram—with the treble turned down?

SHOCKING

Perhaps it is but, on good quality equipment and judged on present-day hi-fi standards, the reproduction is shocking. And, as I said earlier, the problem seems to extend into the LP field, at least in respect to some of the "pop" and "middlebrow" records I have come across.

In quieter passages the reproduction may be excellent but on peaks . . . oh man. You could scarcely do worse by shorting out the bias circuits in the amplifier.

In saying this some caution is necessary, of course, because, while distortion may be inherent in the record, it may equally well relate to :—

(a) The ability of the relevant pickup to track heavily modulated grooves or

(b) The possibility of the amplifier overloading on signals of unusual magnitude.

In the first case, a given record may

Don't get all HOT and BOTHERED this summer.

Keep COOL with this

"PILOT STAR"

Battery operated Fan.

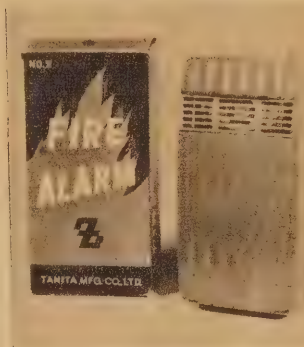
Uses 2 950 batteries.

Only 34/ complete.

Post., 2/6 extra.

Protect your home with this

FIRE ALARM



Uses 1 950 battery.

This unit can be converted to door bell, morse set, etc. No installation; just hang on wall.

Only 11/6 with battery

Post., 2/6 extra.

At this special price you can afford to protect every room, workshop, garage, etc.

HERE IS A SPECIAL FOR FATHER'S DAY

"SENATOR" BATTERY SHAVER

Uses 2 935 batteries.

Only 87/6

Post 2/6 extra.

Spare heads and cutters available.

PRICE'S RADIO

5 and 6 ANGEL PLACE, SYDNEY

Phone BL3146

STAR

TRANSISTOR TELEPHONE . . .

. . . AT YOUR SERVICE

Here is a simple, trouble-free inter-communication system which is easy to install and operate anywhere—in homes, offices, factories, hotels, theatres, on farms, construction sites (distances up to ten miles).

The unit comprises two grey plastic handsets, each fitted with a spiral cord and plug and socket.

Each handset incorporates a two-transistor amplifier powered by two Type 915 (1.5 V) cells contained in the grip. This grip is fitted with a red calling buzzer button and a black speaker button.

Multiple installations can be made by series-connecting any number of handsets. Farmers can use single strand fence wire and earth each phone.

STAR phones are reliable and serviceable:

- No buzzer vibrator to give trouble as in conventional telephones.
- No switching necessary before taking up the instrument. Operation is quick and easy with one hand. Just pick up, press call-button and talk.
- No other equipment. Instrument is self-contained and is conveniently mounted on a small wall bracket supplied.
- No troubles with installation. Double lines without polarity make installation easy, even for the amateur.

RETAIL PRICE £19/3/- per pair
(including batteries)

Twin bell wire, extra.—8d per yd.

For trade enquiries and technical literature contact—

The Distributors,

RADIO PARTS PTY. LTD.

562 Spencer St., MELBOURNE.

ppear distorted in some conditions but ay cleanly with a selected high-grade ckup. Ostensibly the recording organ- ation then stands justified, while the ckup manufacturer is condemned.

But is it—or are they?

I have my doubts.

Ideally, every record buyer should be uipped with a perfect pickup. In fact, ch an item has not yet been produced spite the optimism of individual com- nent manufacturers.

AVERAGE" PICKUPS

A certain proportion of record users ave good pickups by modern standards. me have very poor pickups but the ajority have the "standard" kind of nit which has emerged, by supply and mand, as the one which manufacturers n produce for the price which the verage buyer is prepared to pay.

The performance of these "standard" ckups has gradually improved over the ars and reflects the "state of the art" a particular level.

It seems to me that one can advance pretty good argument to support the lea that groove accelerations should be lated realistically to what good average ckups can handle—not to what they n't.

I doubt, however, that argument on ich a plane is really involved, parti- ularly as my remarks apply mainly to ie "pop" field.

Basically, it is a race to be on sale rst with the loudest version of the test hit with the biggest name. In the rocess, technical standards are liable to by the board.

Fortunately, it seems, a different pproach is maintained to recordings at the classical end of the scale. According to our reviewer, Julian Russell, while classical records may not always be perfect, examples of sheer bad recording are rare.

As I mentioned earlier, there is one other aspect of this amplitude business, which cannot be ignored. It relates mainly to amplifier design.

In many amplifiers the pickup output voltage is fed directly to the grid of the first amplifier valve. The volume control is in its plate output circuit. The arrangement is used to minimise background hum and hiss problems which can occur when the volume control is placed too early in a high-gain amplifier system.

OVERLOAD?

It does, however, involve the possibility that the output from a more than usually sensitive pickup, riding a very heavily modulated groove, may drive the first valve to overload on peaks. Since the volume control follows this first valve, the overload effect persists irrespective of the level of sound from the loudspeaker.

In an amplifier following this basic pattern, it is best to manipulate the input stage conditions so that the amplifier has just enough gain to achieve full output with a low level recording and the gain control fully on.

Where the gain is excessive, it can be reduced by replacing a high-gain input triode with one having a lower amplification factor, preferably with an accompanying appropriate change to the bias resistor.

A pentode input stage can be rewired as a triode or used under lower gain conditions.

Alternatively, a potentiometer can be wired to the input circuit and preset so that only just enough signal reaches the first grid to drive the amplifier to full output with the normal control fully on.

Once again, a basic fault like this in amplifier design should not be encountered too frequently but the possibility cannot be overlooked.

All too often, when this and other possible causes of distortion have been checked upon, we find ourselves back with the record.

TYPICAL EXAMPLES

Just a week before landing in hospital, I took home some eight or nine "middlebrow" records of various labels for review.

Three were quite unacceptable for either hiss or distortion or both. I tried three separate pickups and two separate amplifiers, with identical results.

Next day I had a word with a friend who has some of the best equipment that money can buy. Said he: —

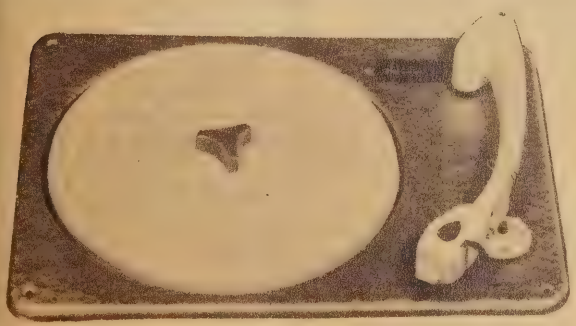
"I bought four records last weekend. Two of them were a waste of money."

And that is the position, I am afraid, in which we find ourselves.

The real problem today is not so much mono versus stereo or tape versus disc—all of them can be superb; it is the sacrifice of engineering standards for a temporary commercial advantage.

There's nothing new about this, of course. Nor is it peculiar to recorded music. But it doesn't do any harm to draw attention to such grievances now and again.

It could even be that some labels might become noted over others for their more rigid observance of good engineering practice.



NOW FREELY AVAILABLE

THROUGH LEADING TRADE HOUSES

the Labcraft Stereo Turntable Type 573v.

FEATURES: 4 speeds, each adjustable, plus or minus 10 per cent.
Complete with arm and auto-stop.

Feather-weight stylus drop control protects your precious discs. Unique, simple motor suspension and soft rim-belt drive which COMPLETELY ISOLATES ALL RUMBLE from pick-up arm.

No mounting springs necessary (unless speaker in same cabinet) — baseplate of unit screws straight on to your mounting board. Spring kits available as extra.

Adjustable stylus pressure 5-10 gm.

Interchangeable heads. Normally supplied with Ronette type 105 t./o. stereo cartridge (not yet available elsewhere).
A full range of heads to fit this arm is also made by "ORTOFON."
All spare parts in stock and service readily available.

This HIGH PERFORMANCE TRANSCRIPTION TURNTABLE now truly brings Laboratory Craftsmanship within the reach of all connoisseurs of quality. Supplies have been short, but we are now able to supply all requirements from Stock.

Retail price: Type 573V with 2 sapphire stylii .003in and .0075in radii, £22/10/-.
With .003in sapphire and .0075in imported Stereo diamond, £23/15/-.

COMING SOON!

The Labcraft Stereo Changer model 594V — changes 45's only. 4-speed with t./o. Ronette type 105 cartridge. Zero Rumble, Wow, and Flutter, due to unique motor isolation as used in the type 573V above.

Trade Enquiries to Sole Australian Agents:

G.R.D. INSTRUMENTS PTY. LTD.

6 Railway Walk, Camberwell, Victoria.

Phone . . . 82 1256

Distributed in Victoria by: Douglas Radio, Malvern—Electronic Developments, Melbourne—Encel Electronics, Richmond—J. H. Magrath and Co., Melbourne—Thomas Pty. Ltd., Melbourne—Warburton Franki Industries Melbourne Pty. Ltd., Melbourne.

All other States: Enquire through your regular Trade House.

TYPE 16 XA

CRYSTAL MICROPHONE

complete with
Base and Stand Clip

AUSTRALIAN MANUFACTURE
HAND–DESK–STAND
—— USE ——

Price complete
£6/8/8 plus
Tax Retail

Metal case finished Burgundy and Gold

Stand clip attached to base by captive screw and easily removed for stand operation in conjunction with Type 208C Adaptor.

Frequency — 70-6500 cps.

Output level — 42db (0db-1volt/dyne/cm2)
Impedance — Grid (1 to 5 megohms.)

Use adaptor 208C
with stand clip

Manufactured by

ZEPHYR PRODUCTS PTY. LTD.
58 HIGH STREET, GLEN IRIS, S.E.6, VICTORIA
MANUFACTURERS OF RADIO & ELECTRICAL EQUIPMENT & COMPONENTS

METROPOLITAN RADIO SUPPLIES

● 640 KING STREET, NEWTOWN, N.S.W.

SANWA P1 MULTIMETER

The Sanwa P1 Multimeter is noted for its reliability, accuracy and low cost.
AC and DC VOLTS: 6V, 30V, 150V, 600V (2,000 ohms/V).
DC CURRENT: 150mA.
RESISTANCE: On 100K ohms complete with batteries and test leads—ONLY

£3/10/-

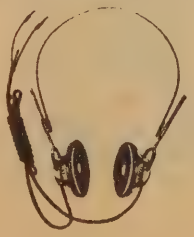
(Postage, 7/6.)

SUPER VALVE SALE

1A5GT	7/6	1D4	6/6	1H6 G	5/	1J6G	7/6
1K5G	4/6	1K7G	3/6	1M5 G	4/6	1P5GT	1/6
1Q5GT	1/6	1T4	4/6	6AB7	6/	6AC7	2/6
6AG5	4/9	6AJ5	9/6	6C4	5/	6C8G	7/6
6G6G	12/6	6J7G	4/9	6L7	12/6	6R7GT	12/
6SF5	7/6	6SH7	2/3	6SJ7GT	10/	6U7G	5/
6X5GT	9/6	7A6	5/	7A8	5/	7C4	5/
7C7	2/	7E5	5/	7W7	2/6	12A6	7/6
12C8	10/	12H6	7/6	71A	10/	217C	150/
328A	2/6	803	30/	807	11/6	809	19/6
815	29/6	830B	10/	832A	35/	954	1/6
958A	1/11	7193	1/6	7006	7/6	AY11	1/11
ECS4	4/6	EF50	1/6	EL32	15/		

(Postage 9d. First Valve, 1d each additional valve)

ALL PERTH ENQUIRIES TO:—
ANDY ANDERSON, 328 MURRAY ST., PERTH.
PLEASE NOTE—however, that prices are slightly higher in W.A.
SORRY, NO C.O.D.



LOW IMPEDANCE HEADPHONES

New, imported, low impedance headphones suitable for use with tape recorder, mine detectors, etc.

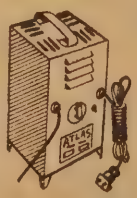
17/6 (Postage 3/6.)

SCOOP PURCHASE! RECORDING TAPE

Double-sided 1200ft rolls on standard 7in plastic spools. (Post 3/) **35/-**

RADIO RECEIVER

Marconi No. R1155 modified to 240 volts, mains operation 6V6 output stage and supplied with a 10in speaker. (Delivery to Rail, 5/) **£45**



BATTERY CHARGER

Suitable for charging 6 Volt batteries at the 5 amp rate. Complete with lead and plugs, plus a female socket which can be permanently wired to your battery enabling you to plug in at a moment's notice.

(Delivery to rail, 5/-) **£5-0-0**

IN REVIEW—By JULIAN RUSSELL

FINE KHATCHATURIAN CONCERTO

Khatchaturian — Concerto for Piano and Orchestra in D Flat Major.

Prokofieff—Concerto No. 1 in D Flat Major, Op. 10. Played by Mindru Katz and the London Philharmonic Orchestra conducted by Sir Adrian Boult. Pye Mono PLC 5010.

Most pianists hammer out long stretches of the Khatchaturian Concerto ferociously. Indeed, until I listened to this recording I have never heard it played any other way. But Katz approaches it much more gently, and in doing so makes it, for this listener at any rate, eminently more attractive.

It is obvious that Katz has all the technical equipment necessary to make the concerto a vehicle for virtuoso display. But instead, although he can obviously be as percussive as the next when he wants to, he retains, without ever thumping his instrument, enormous rhythmic vitality throughout.

He also has the knack of keeping the music moving forward. He never marks time in the same spot as so many other pianists do. His ornamentation is a delight and sets off to perfection long, beautifully shaped cantilena passages.

I can recommend this as the best performance available, both in its solo aspect and that of the admirable accompaniment, always in exemplary balance, supplied by Boult and London Philharmonic.

The sound is excellent and makes audible the curious timbre of the flexatone which figures so prominently in the second movement.

I can also recommend the coupling, the First Prokofieff Concerto, presented along much the same lines by the same artists. This is an early work, written while Prokofieff was still a pupil at the St. Petersburg Conservatorium and disapproved of rudely by Glazounov, a senior tutor there, who advertised his displeasure by walking out of the hall during the first performance.

While the concerto displays some of the brittle acerbity that characterised much of the composer's later music, one is puzzled by Glazounov's pedantic attitude at a time when Stravinsky's Firebird and Petrouchka were already known to and approved by many musicians.

The sound is first rate except for some slight surface noise in the more lightly scored spots.

★ ★ ★

Vaughan Williams — A London Symphony (Revised Version). Played by the Halle Orchestra conducted by Sir John Barbirolli. Pye Mono PLC 5018.

The sound on this Pye disc is much inferior to that on the one noticed above. Its particular weakness is in the tone of the violins. It makes them sound deficient in numbers and thin in quality. And no adjustment I made to the controls of my set could improve matters. There is, too, some tape hiss on the second side that intrudes in the spots where the orchestra is silent.

Barbirolli plays the symphony idiomatically enough to fill cockney exiles with nostalgia but I should have enjoyed it still more had the Scherzo been a little more sprightly and the great march tune in the Finale more warmly stated. There are, however, plenty of compensations to be found elsewhere, especially in the opening movement, the Lento, and the deliciously evocative ending.

★ ★ ★

Operatic Arias — Ancor non giunse! . . . Regnava nel silenzio; Il dolce suono mi corpo di sua voce . . . Ardon g'lincensi (Mad Scene) from Donizetti's Lucia di Lammermoor; Surta e la notte . . . Ernani! involami, from Verdi's Ernani; Bolero from Verdi's I Vespri Siciliani; Ah, tardai troppo . . . O luce di quest'anima from Donizetti's Linda de Chamonix. Sung by Joan Sutherland with the Paris Conservatoire Orchestra conducted by Nello Santi. Decca Mono. LXTA 5531.

Joan Sutherland as Lucia in Donizetti's Lucia di Lammermoor.

This disc of lovely singing will explain to listeners the reason for Miss Sutherland's recent outstanding success overseas. Her voice remains beautifully even throughout its range, its superb quality unimpaired at both extremes of the register, her coloratura passages effortlessly agile, and her legatos sensitively phrased.

Every item she sings here proclaims a faultless musical taste, the more impressive because many of them provide constant temptations to tawdry showing-off. Instead, Miss Sutherland maintains an enchanting purity of style throughout the recital which remains unaffected by the slight coarseness of the treatment of the orchestral sound, though the accompaniments of the French orchestra are always in complete sympathy with the singer.

★ ★ ★

Ravel—Songs. Chanson Hebraique; Deux Melodies Hebraiques; Chansons Madecasses; Melodies Populaires Grecques; Don Quichotte a Dulcinee; Deux Epigrammes de Clement Marot; Ronsard a Son Ame. Sung by Gerard Souzay. Orchestral accompaniments by L'Orchestre de la Societe des Concerts du Conservatoire conducted by Andre Vandernoot, except in the Madagascar bracket, which is supported by Dalton Baldwin (piano), Jean Pierre Rampal (flute) and Robert Cordier (cello). HMV Mono OALP 7513.

More delicious singing is to be heard on this enchanting disc, which presents all Ravel's songs except the Scheherazade group. Seventeen are included in this recital.

The acompaniments are sometimes Ravel's own orchestrations, others being transcriptions by Manuel Rosenthal and Maurice Delage from the original piano version. Those supplied by the last two musicians skilfully copy Ravel's orchestral style.

Souzay sings them all with the greatest imaginable artistry, in a voice that seems able to do anything he asks of it, however exacting his demands. For lovers of French music, and Ravel's in particular, this is a "must." It should serve, too, to introduce to those unfamiliar with this type of song, the exquisite subtleties of Ravel's vocal compositions.

Unfortunately no translation of the texts is provided. When he is singing in French, Souzay's faultless diction makes this omission unimportant to those who know the language. It will be no help, however, to all but a few, in the three numbers he sings in Hebrew and Yiddish, and the two Epigrammes in archaic French. But though the actual words might not be known, Souzay's expressive style leaves the listener in no doubt as to the meaning.

★ ★ ★

Bruch—Concerto No. 1 in G Minor for Violin and Orchestra. Lala — Symphonie Espagnole for Violin and Orchestra. Played by Christian Ferras with the Philharmonia Orchestra conducted by Walter Susskind. H.M.V. Mono ALP 1746.

The ardour that made this young French violinist's performance of the Tchaikowsky Violin Concerto such an exciting experience is here carried to excess. Ferras plays both works "molto espressivo," slithering up and down the fingerboard of his instrument in portamentos that might sound better on a musical saw.

Although his technique remains as formidable as ever, he displays moments of carelessness, notably in his intonation of some of the arpeggio passages in the first movement of the Lalo. Is this due to a supercilious approach to nineteenth century romanticism? I strongly suspect so. For in everything else I have heard

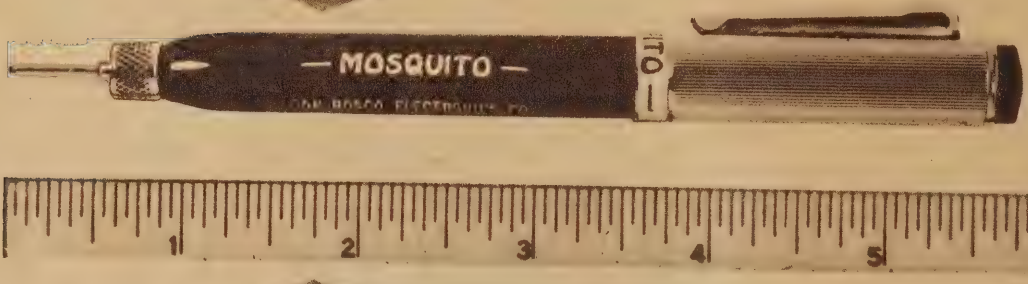
RADIO SERVICEMEN

TECHNICIANS

ELECTRONIC ENGINEERS

the sensational
transistorized signal injector
"MOSQUITO"

Manufactured in U.S.A.



for testing

radio, telephone service, sound and electronic equipment

The "Mosquito" signal injector is a self-contained, light weight, miniature, long-life shirt pocket size instrument, generated from basic mid audio frequency (approx. 1.5 KC) to high radio frequencies in harmonics. Operated on a single 1.5V Eveready Battery — or equivalent. Can be inductively coupled to all magnetic sensitive pick-ups and circuits without direct connections with leads. Transistor gives extremely long life and dependable service.

following are some applications of the "Mosquito"

SERVICE TO RADIOS, A.F. AND R.F. SECTION;
HEARING-AIDS;
TELEPHONE SERVICE WORK;
CONTINUITY CHECK OF RESISTOR AND CAPACITOR;
TAPE RECORDERS;
SOUND MOVIE PROJECTORS;
TELEVISION, A.F. SOUND SECTION

PRICE £6 (including postage)

Obtainable DIRECT from...

BROWN & WATSON ELECTRONICS Pty. Ltd.

281 Latrobe Street, Melbourne. MU 8186

rras play he has always maintained a iltless style, from Bach to Brahms, th on the concert platform and in the :ording studio.

Susskind and the Philharmonia supply exemplary accompaniment in both :es on this new disc, matching his ods, whether for better or worse, with ole-hearted co-operation. The sound splendid and the balance unexception-le. And even Ferras' readings may be proved in some quarters.

★ ★ ★

Mendelssohn—Concerto in E Minor for Violin and Orchestra, Op. 64. Prokofieff—Concerto No. 2 in G Minor for Violin and Orchestra, Op. 63. Played by Jascha Heifetz and the Boston Symphony Orchestra, conducted by Charles Munch. RCA Mono L16222.

This is violin playing of a differ-t calibre altogether. Heifetz never ils to demonstrate his respect for the usic he is interpreting and is obviously sincerely appreciative of Mendels-hn's elegant romanticism as Prokofieff's ore austere contemporary thought.

He must now have been playing the endelssohn Concerto for close on half century, yet still manages to present with freshness and spirit. And it is tonishing how little his reading has ried over the years. He still takes e Finale at breakneck speed without e smearing of a single note, and finds portunities to become quite rapturous the first.

At well over 60, his vast technical sources, too, remain unimpaired. There not a slipshod bar in either of the o concertos recorded here. And his ne is as thrillingly vibrant as it was his early manhood. Munch stays with m with admirable tenacity, but never the role of a mere satellite.

His accompaniment is always sym-thetic and the sound first rate if one prepared to accept a balance that, to is listener, favours the soloist rather ore than it should. This coupling of endelssohn with Prokofieff might not peal to all tastes, especially since the cond Prokofieff is a much sterner work an the more popular First, which eifetz recorded incomparably on 78s ck in the early 1930s.

★ ★ ★

The French Touch—The Sorcer-er's Apprentice (Dukas); Omphale's Spinning - wheel (Saint - Saens); Mother Goose Suite (Ravel). Played by the Boston Symphony Orches-tra conducted by Charles Munch. RCA Stereo SL16227, Mono L16227.

Connoisseurs of French music will ap-reciate the sensitivity of Munch's di-ction of his fine orchestra. And the lection offered here should appeal to wide audience. The Dukas piece is ow well enough known to all types of steners, thanks to its inclusion in Dis-ey's Fantasia, to need no description om me, except to point out that funch plays it with exquisite polish nd wit.

He takes Omphale's Spinning-wheel at pace that has it always moving nicely rward and keeps the movement going en during the pesante strivings of the cond subject.

Mother Goose is a delight from be-nning to end with brilliant solo work om the accomplished wind players in articular.

The mono sound is good, the stereo beautifully distributed in both width and depth. On both the triangle is a trifle too assertive in L'Apprenti Sorcier, but otherwise the balance is everywhere first-rate.

★ ★ ★

Beecham Encores—The Last Sleep of the Virgin (Massenet); Overture and March from The Trojans at Carthage (Berlioz); March from Karelia Suite, Op. 11. Incidental Music to The Tempest (Sibelius); March from Le Coq d'Or (Rimsky-Korsakoff). Played by the Royal Philharmonic Orches-tra conducted by Sir Thomas Beecham. Coronet Mono KLL594.

This is an attractive selection of short pieces, none of them trivial if one ex-cepts the Karelia item. A glowing string tone enriches the texture of Massenet's "Last Sleep of the Virgin." Then it is the brasses' turn in the opening to The Trojan March, where the fine engineer-ing exposes the greatness of Berlioz' scoring. Under Beecham the procession becomes inspiring pageantry.

Jasha Heifetz

Following this impressive writing, Sibelius' Karelia March sounds very second-rate. One of the tunes might have been taken from a Christy Min-strel show.

Beecham takes the beginning of the Coq d'Or number almost daintily, so precisely is it enunciated. But it soon grows in stature and glitters its way to a climax of magnificent elan. Neither the sleeve nor the label gives any iden-tification of the pieces that make up the incidental music to Shakespeare's The Tempest, written by Sibelius very late in his working life which finished inex-plicably some 25 years before his death.

From what I remember of this music after a lapse of many years the Over-ture comes third in the arrangement—a veritable tempest with, however, rather too abrupt an ending. Except for a trace of pre-echo here and there the mono sound is superb and the company has no plans for a stereo release.

★ ★ ★

Chopin Commemoration, Volume 1. Study No. 2 in A Flat Major. Study Op. 10, No. 3 in E Major; Study Op. 10, No. 4 in C Sharp Minor; Preludes, Op. 28, Nos. 1 in C Major, 4 in E Minor, 7 in A Major, 15 in D Flat Major, 17 in A Flat Major; Nocturne Op. 55, No. 1 in F Minor; Nocturne Op. 62, No. 2 in E Major; Nocturne, Op. 9, No. 2 in E Flat Major, Impromptu, Op. 39 in A Flat; Impromptu Op. 51, No. 3 in G Flat Major. Played by Barry Gibbons. Rex Mono RA-2001.

Barry Gibbons is a 27-year-old Aus-tralian ex-pupil of Backhaus and other distinguished foreign tutors. He plays nicely, especially the slower, simpler pieces. There is throughout his recital a tendency to restlessness in places where one expects serenity, or at any rate, tranquillity, and at times he crowds his fast passages together.

In these days of fierce competition from other outstanding young pianists all over the world Mr Gibbons is only mild-ly interesting. The piano tone is very plummy on my pressing. The Rex label, an off-shoot of Festival, has as its motto "The Voice of Australia."

★ ★ ★

Gounod—Faust (complete). Vic-toria de los Angeles (soprano), Liliane Berton (soprano), Rita Gorr (contralto), Nicolai Gedda (tenor), Boris Christoff (bass), Ernest Blanc (baritone), Victor Autran (baritone). With the Chorus and Orchestra of the Paris Opera conducted by Andre Cluytens. Libretto in French and English supplied. HMV Mono OALP 1721/4.

When I was a boy Faust was easily the most popular opera among people who attended that type of entertainment perhaps once or twice a year. Running it a close second was Verdi's Il Trova-tore. English travelling companies like the Carl Rosa relied on those two for their biggest houses during their short seasons.

Nowadays they might still attract audiences of old-timers in the English provinces but they seldom reappear on metropolitan stages. And this is reflected in the dearth of recorded versions of Faust, only two of which are still listed in the English classical LP catalogue.

Faust is, of course, an extremely diffi-cult opera to sing well and Italian artists seldom seem able to get the idea of a French "style." And this new set has an Italian tenor, a Spanish soprano, a Bul-garian bass, and a French baritone in the principal roles, a combination that offers no great promise of the "perfect performance" so long awaited by dis-cophiles.

For a non-French Marguerite, Vic-toria de los Angeles is admirable. She offers singing of heart-warming beauty and manages the acting side of her role competently, without however, ever sounding exactly right stylistically. Gedda's Faust is efficient rather than in-spiring, Rita Gorr's Martha a mite too impressive even in her important con-tribution during the quartet, and Liliane Berton's Siebel both fragile and lifeless.

Hopelessly unsatisfactory is Christoff's Mephistopheles with his barbaric French accent, his blustering approach to a role that should be played sardonically, and his incongruous moments of outstand-ing brilliance. Ernest Blanc's wholly satisfactory Valentine makes too slender a contribution to outweigh the short-comings.

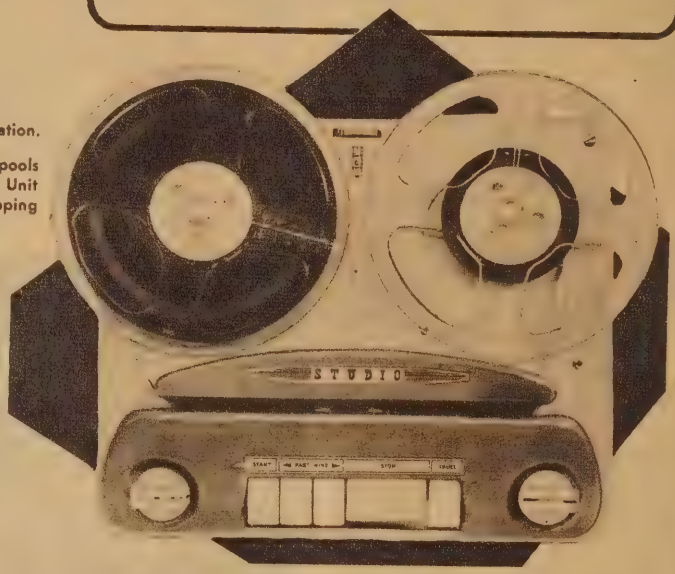
Having got that off my chest, I can go on to say that the engineering is first rate, the balance always in faultless equil-

COLLARO STUDIO TAPE TRANSCRIPTION DECK

★ *Finest Quality!* ★ *Fully Imported!*
★ *Unbeatable Low Price!*

BRIEF SPECIFICATIONS: —

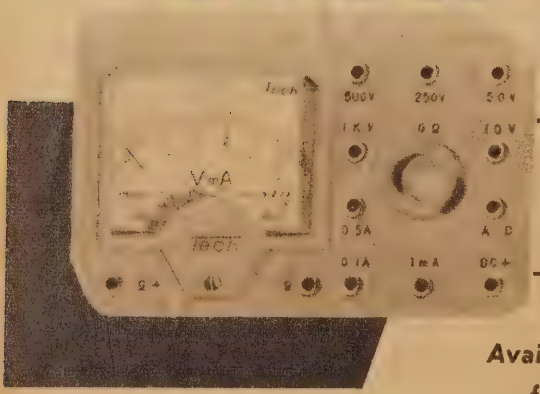
No. of Tracks:	Two
Operating Speeds:	1⅞, 3¾ and 7½ I.P.S.
No. of Heads & Type:	Two — one record/playback, other — erase.
Attainable Frequency Response:	12 KC at 7½ I.P.S. ± 3 db with record/playback equalisation.
Dimensions:	12½" x 10⅝" — with 5¾" spools within the confines of the Unit Plate. With 7" spools overlapping Unit Plate.



ANNOUNCEMENT OF PRICE!

Tech MULTIMETERS

LIST PRICE REMAINS 61/-



Tech Multimeters — 0-1mA 1000 OHMS Per Volt.

AC Ranges	DC Ranges	Current Ranges
0-10V	0-10V	0-1mA
0-50V	0-50V	0-100mA
0-250V	0-250V	0-500mA
0-500V	0-500V	OHMS Range
0-1000V	0-1000V	0-100,000 OHMS

Supplied complete with test leads and costing only 61/-.

Available from Wholesalers everywhere or from the sole Australian Distributors

8313

ELECTRONIC INDUSTRIES IMPORTS PTY. LTD.

VIC.	N.S.W.	S.A.	Q'LAND	W.A.
139-143 Bouverie St. Carlton — 34-4161	121 Crown St. East Sydney — FL 5041	90 Grote St. Adelaide — LA 5295	372 Ann St. Brisbane — 2-6462	68a Railway Parade West Perth — 28-3111

orium, and the orchestra and ensembles ompetently managed by Cluytens, hough some of his sprightlier items ave a tendency to plod.

A stereo version is due to appear soon n the local market and a two-channel ecording could redress some of the aults of the mono, or at any rate, make nem seem less obvious. My advice, owever, is to try before you buy.

★ ★ ★

Tchaikowsky—Symphony No. 5 in E Minor, Op. 64. Played by the London Philharmonic Orchestra conducted by Sir Adrian Boult. W. and G. Stereo. WG-ACM-866.

The "motto" theme finished, Boult oes on to take the first subject of the rst movement as deliberately as if he vere leading a party through a mine-ield, accented in a manner that lends an odd rhythmic effect. But before ong he reverts to more orthodox empos inflamed here and there by real assion. Not that his ardour ever gets ut of hand. It is always well on this ide of frenzy.

Particularly attractive are the softly ketched-in string "chucks" that seem to upport the bassoon solo on a cushion f air. But this modest start is later eplaced by string tone of great richness nd vitality, brass that has a true snap n its attack and release, and nicely ac-urate woodwind playing. There is a eautifully veiled horn solo in the An-lante Con Moto.

Boult takes the Waltz movement at a empo that makes it sound ever so lightly glum. By the way, I should ave thought the irritating turn-over that nterrupts the slow movement might ave been avoided by the exercise of little thought since a fair amount of laying-time is left on the second side.

The Finale is as bright as a button, ull of well-disciplined vigour. The en-gineering is first-rate—widely and deeply pacious, with a full, but not unwieldy lynamic range. Boult's reading, though eminently scholarly without pedantry, might have been more exciting had it all been a little more closely knit.

★ ★ ★

Beethoven—Symphony No. 5 in C Minor, Op. 67. Played by the Philharmonic Symphony Orchestra of London, conducted by Artur Rodzinski. Westminster Mono WG-W-18074.

Rodzinski's is a conventionally good account of this, probably the most popular symphony ever written. He makes every point efficiently and some of them imaginatively. The engineering, however, is far from satisfactory. There are empty spaces in the orchestra between the treble and the woofy bass and no adjustment I was able to make on my set effected any great improvement.

I don't think buyers will have to wait long before something better is offered. Indeed there are many splendid mono versions of this symphony already available on the local market at prices to suit all pockets.

★ ★ ★

Ballet (Highlights from the Opera)—Verdi: Aida Ballet; Wagner: Venusberg Music; Saint-Saens: Bacchanale; Rossini: Passo a Sei; Ponchielli: Dance of the Hours, played by the Concert Arts Symphony Orchestra conducted by Erich Leinsdorf. Capitol Stereo SP 8488.

The sound is well spread, though the treble, for my taste, could be a little sharper. As it is, the effect is slightly damped down and dry. Capitol can do better than this, and so can Leinsdorf.

The latter uses the Paris version of the Venusberg Music and drives it along with plenty of energy, but his trumpet call at the peak of the frenzied climax sounds like a cavalryman bugling the charge instead of a transformation of the Venus theme.

In an abridged version of the Saint-Saens Bacchanale from Samson and Dalilah he becomes bacchanalian too early leaving very little to build on later. And most of the other times lack the touch of polish and authority that Leinsdorf can provide at his best.

The sleeve is one of Capitol's gaudiest, depicting a ballet girl practising in a swimsuit watched by a stage electrician whose interest seems to put him in danger of receiving a fatal shock from his switchboard.

OTHER ITEMS — REVIEWS IN BRIEF

50 years of Great Operatic Singing. Tenors Caruso, McCormack, Gigli, Martinelli, Schipa, Johnson, Melchior, di Stefano, Tagliavani, Peerce, Bjoerling and Valetti in Arias, mostly from Italian Opera. RCA Mono L16225.

Here are great voices, most of them rom the past, in a generous program f popular arias. Some of the tracks ave been taken from 78s, others are nore recent. All are worth listening to, nd old-timers will complain that they eldom hear singing of this quality in hese degenerate days.

★ ★ ★

Jamaica — An Original Cast Album of the Broadway Hit Musical Comedy starring Lena Horne and Ricardo Montalban, the production conducted by Lehman Engel. RCA Mono L10881.

This pleasing pop disc includes many alypso-type tunes, some of them with ery frank, witty lyrics. The majority re topical—"Leave That Atom Alone" s typical. Recommended to those in-erested in this type of production.

★ ★ ★

Music From Million Dollar Movies. — Theme Songs and other items from Love Is a Many-Splendored Thing; Suicide Squadron; While I Live; Love Story; Intermezzo; Gigi; The King and I; Around the World in 80 Days; Laura. Played by the Boston Pops Orchestra conducted by Arthur Fiedler. RCA Stereo SL 16232.

This too can be recommended to lovers of lighter music. The numbers are played with the good taste and careful attention to detail that characterises all Fiedler's work. The sound is good.

★ ★ ★

The Fabulous Josephine Baker—Negro singer in mostly French ditties with Orchestra conducted by Jo Bouillon. RCA Mono L16231.

The rich, warm personality of Josephine Baker comes through admirably on this enjoyable disc. She sings mostly in French though there are a few choruses in English and one song in German. A small chorus occasionally adds extra colour to the excellent support of the small band. And while the absence of translations of the texts might sometimes leave the singer's meaning in doubt, there is never a moment of monotony.

TUDOR RADIO

L. E. Chapman

418-420 KING STREET, NEWTOWN

near Newtown Station

Estd. 1940.

LA1011 LA1011

TV Cabinets 17, 21, 24 inch. New. . . . . £5.

New part assembled TV Chassis including IF strip EHT unit, Choke, speaker transformer, frame, output blocking, Osc condensers, valve sockets, line output, fuse box etc. 110 deg. . . . . £8 each.

Power transformers, small 60 mil. . . . . £1.

Speakers, Magnavox, 8 pix, twin cone. . . . . £2.

Rola or MSP 6 x 9. £1/10/.

Picture tubes, new 17 inch 90 deg. . . . . £19/10/.

110 deg. 21 inch. £19/10/.

Electric gramophone, motors and pick-ups. 4 speed, well-known make. . . £7/10/.

Valves. Radio tested, old or modern types. ½ list price

Garrard Mk 2, plug in stereo heads. . . . . £2.

TV Aerials, indoor. £2/17/6 Outdoor £3/5/ to £12/10/.

Power transformers, old types . . . . . 15/.

2 Gang Condensors, new . . . . . 10/ each.

ENCLOSURES

T-V. CABINETS, KITS AND ASSEMBLED.

CABINET KITS

160 HIGH STREET, ST. KILDA, S.2.. VICTORIA. Tel.: 94-4819.

TRADE REVIEWS AND RELEASES

COMPACT DOUBLE-BEAM MEASURING OSCILLOSCOPE

A double-beam version of the well known and respected Telequipment "Serviscope" oscilloscope has been recently released in this country by Jacoby Mitchell and Co., Pty., Ltd. Available in either the portable version shown or a rack-mounting version, the unit has the versatility of the Serviscope with the added features of a double-beam instrument.

DESIGNATED the type D31, the new unit differs slightly from the earlier single-beam version. The calibrated timebase now has 18 pre-set sweep speeds, covering from 1 microsecond/cm to ½ second/cm. Slower speeds are obtainable. A variable control allows intermediate speeds to be obtained.

An edge-lit illuminated graticule is provided, with a control to adjust the graticule brightness. An improved triggering circuit gives improved steadiness on difficult waveforms with a repetition rate of from two or three cycles to 1 Mc/s, and the timebase may be triggered at any point on the input waveform.

The twin Y amplifiers are completely DC coupled throughout, both having a DC to 6 Mc/s band-width. The calibrated input attenuators allow direct measurement of voltages from 100 mV/cm to 50V/cm, the input impedance being 1 Megohm and 30 pF in parallel. The Y amplifiers are completely separate, a double-gun cathode ray tube being used rather than a "splitter" type.

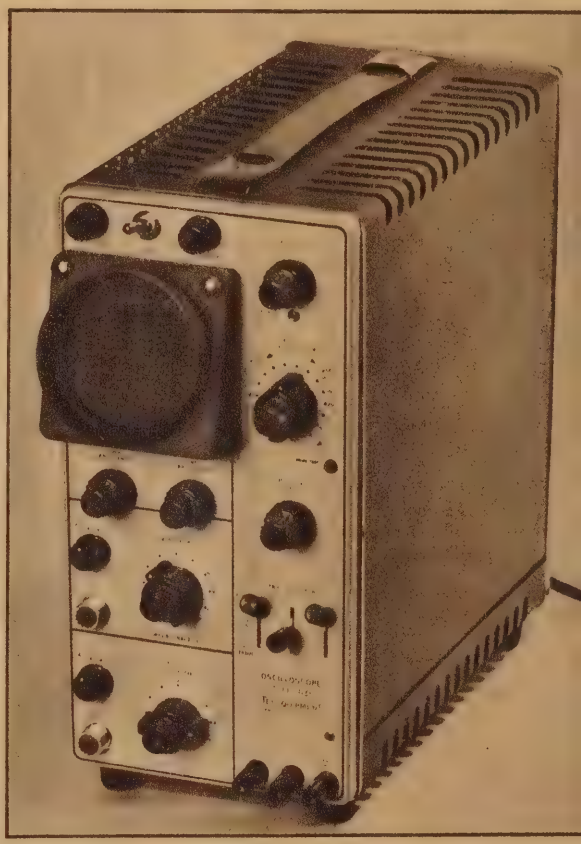
An X expansion control enables the trace to be expanded symmetrically up to 10 times, and an inbuilt TV synch separator allows the timebase to be locked at line or frame frequency with a video input signal.

A built-in voltage calibrator with a stabilised 1 volt peak-to-peak 50 c/s squarewave output enables the timebase and Y amplifiers to be accurately set and calibrated in the field.

The 3½in flat faced tube is operated at 1600 volts, and is tilted for convenient viewing when used on the bench. Medium (PI) persistence screen phosphor is normally supplied, but P7 and P11 long and short persistence phosphors are available on request.

In short, this unit is a fitting successor to the popular "Serviscope" oscilloscope.

Our sample was supplied by the Australian agents, Jacoby Mitchell and Co. Pty. Ltd., of 469 Kent Street, Sydney, to whom all inquiries should be directed. The pri is quoted as £170 plus tax where applicable.



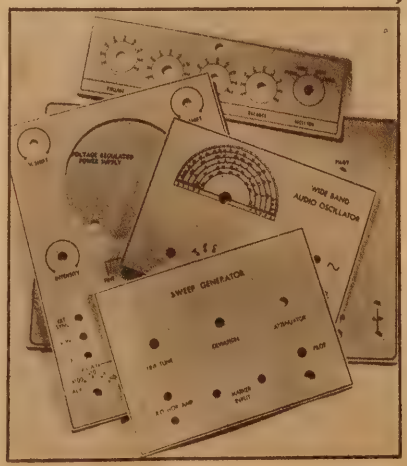
The Telequipment D31 double-beam oscilloscope measures 13in x 6½in x 13in and weighs 26 pounds. It is thus quite portable.

ENGRAVED PANELS FROM OXFORD

R. H. Oxford Pty. Ltd., Marriott and Telopea Streets, Redfern, N.S.W., make available a considerable number of engraved aluminium panels for Radio TV and Hobbies designs. Many of these have multi-coloured engraving for clarity and ease of operation, and all are made from our published blueprints.

A few samples from their wide range are shown here. Panels are visible for the Voltage-regulated Power Supply, the Five-inch Oscilloscope, the Wide Band, Audio Oscillator, the Simple Sweep Generator, and the Stereo Control Units. This last panel is also used for the two Unit Stereo Amplifiers.

All panels are well finished and may be obtained with the appropriate instrument case and chassis.



A.W.V. PUBLICATIONS

A.W.V. have just released two publici items which should be of conside able interest to servicemen and technic workers. One is a TV valve slide ru which can be used to determine t function and type of every valve used 22 leading makes of TV receiver. Scal are marked according to the vario sections of the TV receiver and the mo ing section of the slide rule is mov to place the desired make of set alon side the scales.

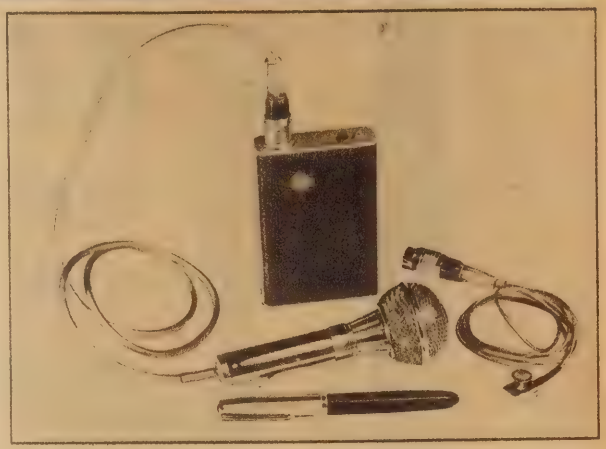
The valves used in that receiver in t particular position considered are th read off as numbers, which are convert to valve types via an attached table.

The second item is a data pamph on "premium" and special quality valv It gives the type, class and prototy valve for some 61 of these special valv and indicates which types are intend for renewal use only.

Information regarding these items m be obtained from A.W.V. Technical Pu lications, Box 2516, G.P.O., Sydney.

TRADE REVIEW—CORDLESS FM MICROPHONE

Overseas TV and radio stations have long used self-contained radio-linked microphones as a means of solving the connecting cable problem while retaining good sound quality. These units have not been easily available in Australia in the past, but this situation has been recently remedied by the release of Telefunken "MIKROPORT" equipment.



WITH the Mikroport system the speaker gets a microphone about the length of a fountain pen. This has a frequency response of 100 to 12,000 cps, plus-minus 3 dB, ensuring broadcast quality sound transmission. It has a cardioid response (15 dB front to back ratio).

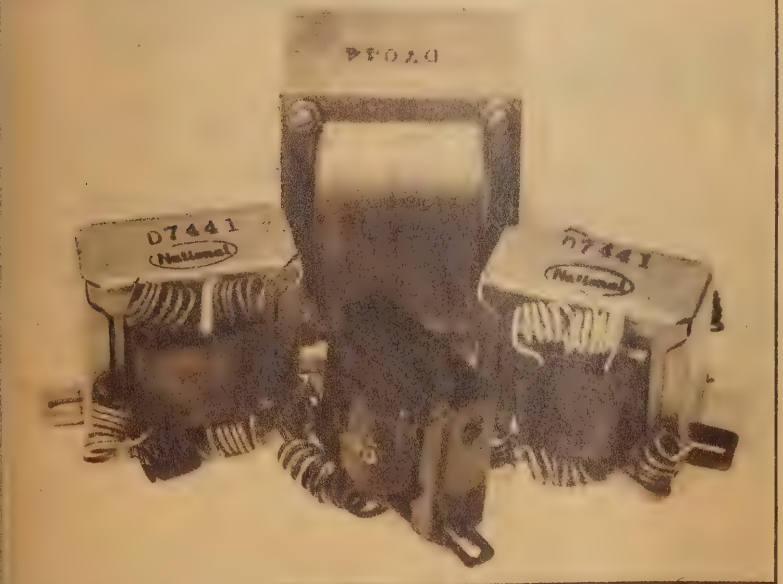
There is also a tiny buttonhole microphone having a frequency response of 400 to 4000 cps. Each microphone has an output impedance of 200 ohms.

The heart of the system is a miniature FM transmitter working on 36.7 or 37.1 mc/s. Its total distortion is less than 2 per cent, frequency deviation plus-minus 40 kc/s. All transistorised, the battery transmitter weighs only 6 ounces and is easily tucked away in a pocket. The lead from the microphone serves as an aerial providing a range of over 100 yards.

Signals are picked up by a mains operated receiver which has an output of 1.55 volts and 1000 ohms rated load impedance. Its audio frequency response is 100 to 15,000 cps and harmonic distortion less than 2 per cent. It can feed most audio channels or public address systems.

Further information concerning performance, price, etc., of the system described may be obtained from the distributors, Manufacturers Special Products, 47 York Street, Sydney.

"NATIONAL" TRANSFORMER KIT FOR UNIT PLAYMASTER No. 2



National Transformers Pty. Ltd. have recently released this kit of transformers for the Radio, TV and Hobbies "Unit Playmaster No. 2" stereo amplifier. The kit consists of power transformer, filter choke and two output transformers.

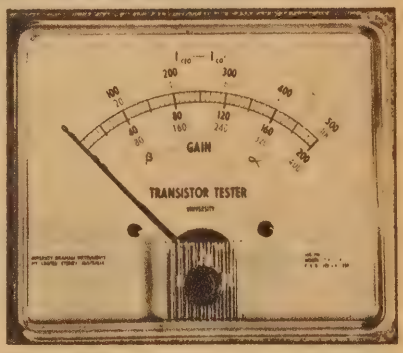
THE power transformer, type D7044, and the choke, type 6965, both have ratings which are adequate for the Unit Playmaster No. 2, and are very well made structurally.

The two identical output transformers, type D7441, measure about 2¼in by 3¼in, and are of the usual U-clamp construction. The primary impedance is 9000 ohms centre tapped, with screen taps at the recommended position for ultra-linear operation.

The secondary impedance is 15 ohms, with taps for 3.75 and 2 ohm connection. The quoted frequency response is 50-15,000 cycles, and tests in our laboratory with the transformers in the actual amplifier would indicate that these figures are quite conservative.

In short, these components are of the highest quality, and very suitable for the Unit Playmaster No. 2 amplifier. The kit should be obtainable from all normal trade houses and suppliers.

METER FOR TRANSISTOR TESTER



READERS intending the construction of the Transistor Tester described in the August issue will be interested in this meter from University Graham Instruments Pty. Ltd., of 5 North York Street, Sydney.

One of the University W4 series, the meter has a two-colour scale made to our own specifications. It is available through the normal trade houses.

AWA RONETTE
MICROPHONES & ACCESSORIES

Type HM7
£6/12/6
Hand or stand microphone filter-cell robust diecast housing. Attractively finished.
CHANDLERS LTD.
Albert and Charlotte Sts., Brisbane.
and leading wholesalers.

A NEW streamlined beauty

AEGIS

POWERFUL STEREO SIX-88

INTEGRATED ULTRA-LINEAR AMPLIFIER

Above: AEGIS SIX-88 AMPLIFIER and left: Mark 2 TUNER

NOW AVAILABLE

IN MATCHING FULLY VENTILATED TWIN CABINETS BOOK SHELF STYLE!

AEGIS NEW, IMPROVED Mark 2 TUNER

Valves: Type 6BE6 Converter, type 6N8 I.F. Amplifier, Detector, and AVC. Power supply: can be drawn from existing amplifier through voltage-dropping adaptor supplied. Alternatively, an outboard power supply is available (Aegis type PS/2) and can be fitted directly to tuner. Power consumption: HT 95 volts DC at 16 mA and I.T 6.3 volts AC at 0.9 A. Response: Substantially flat at 6 Kc. Size: cutout approx. 8¾in wide, 3in high, 3¾in deep. Cabinet 14¼in x 5¾in x 8¼in. Front panel: Average 10¼in wide, 3¼in high. Audio output. Amplitude can be pre-set to match input requirements of any amplifier.

RETAIL PRICE: £46/11/6. Choice of 4 panels including one with knobs to match Quad Pre-Amplifier.

AEGIS STEREO SIX-88 AMPLIFIER

Has full 16 watts of power. 2 independent 8-watt amplifie in one chassis. Push-pull output. Choice of 3 inputs stereo, monaural and radio tuner. Valves: 2 x 12AX 4 x 6BM8, plus two silicon diodes. Each of six are doub valves. Power supply: Full wave voltage-doubler usi silicon diode rectifiers delivers 260 VDC at 130 mA a 6.3 VAC at 4.1 A. No reserve for external devices. P mary circuit incorporates safety fuse. Designed for 2 volts, 50 c/s mains. Front controls: From left to rig Selector switch, bass control, treble control, balance co trol and volume with mains ON/OFF switch. Bass contr At 100 c/s, 11db lift and 9db cut. Balance control: Equ output from both channels to full cut-off on either chann Cut-out size approx., front panel: 13½in long, 4¾in wid depth not more than 7in behind panel. Amplifier mu not be mounted "face-up" however.

RETAIL PRICE: £79/17/6. Fully ventilated, matchi bookshelf cabinet to tuner, optional extra for £6/10/-.

Manufactured in Australia for Australian conditions

AEGIS MANUFACTURING CO. PTY. LTD.

208 LT. LONSDALE ST., MELB., C1, VIC. PHONE FB3731

BOOKS - REVIEWS AND COMMENTS

THE A.B.C. of "ELECTRONIC BRAINS," by Leon Bagrit. Published by the B.B.C. (A compilation of six talks broadcast in the External Services of the B.B.C.) Soft cover, 48 pages.

This small but very well made and nformative booklet on computers is ased on a series of talks broadcast in he External Services of the B.B.C. by Ir Bagrit, Deputy Chairman and Manging Director of Elliott-Automation td. It is designed to explain for the ayman what a computer is, what it can lo, and how it works.

Illustrated with many easy-to-understand diagrams and typical photographs, he booklet starts by explaining what omputers do, the difference between ligital and analogue computers and elenents of binary arithmetic. It then exlains the concept of storage, and disusses input-output equipment for feedng data into and from a computer.

It then discusses the use of computers n the modern world, and finally points o future developments in the field of utomation. Our copy was direct from he publishers, but it probably will be eleased locally in due course. (J.R.)

★ ★ ★

THE JUNCTION TRANSISTOR, by R. W. Hurst. Published by Amalgamated Wireless Valve Co. Pty. Ltd. (reprinted from "Radiotronics".) Soft cover, 32 pages, with diagrams and circuits.

Designed as an introduction to the unction transistor, this booklet explains oth the operation of the unit and its pplication to various electronic devices.

The first section of the booklet exlains transistor action and the common ase configuration, and shows how the arious parameters of the transistor in his mode are obtained.

The next section explains the common mitter and common collector configuraions, and shows the various voltage and urrent relationships in typical circuits ot these types.

The final section is devoted to the explanation of the problems associated with the application of the transistor to high frequency and pulse operation, and discusses temperature effects and transistor circuitry.

Our copy of the booklet was direct from the publishers, but we understand that it is available locally at a price of 3/. (J.R.)

★ ★ ★

UNDERSTANDING MICROWAVES, by Victor J. Young, Ph.D. (Abridged Reprint), Soft cover, 304 pages, 5½in x 8¼in. Contains diagrams, circuits and photographs.

This book is a fairly comprehensive study of microwave fundamentals. It contains quite a deal of mathematics for those who need it, but does not rely purely on equations and relationships to "explain" concepts and new ideas. It is thus quite suitable for the beginner as well as the more advanced worker in electronics and radio.

Chapters of the book are given to electrostatics, magnetostatics, lumped constants in AC circuits, transmission lines, Poynting's vector and Maxwell's Equations. Further chapters deal with waveguides, resonant cavities, antennae, microwave oscillators — their principles and operation.

The final chapter deals with the application of microwave gear in radar and communications. Various transmission and reception systems are discussed and some of the problems in the field mentioned.

Our copy of the book was from the publishers, John F. Rider Publisher Inc., of 116 West 14th Street, New York, N.Y., and the Australian price was not given, but the book will undoubtedly be available locally in due course. (J.R.)

★ ★ ★

MARINE RADIO FOR PLEASURE CRAFT, by Harold McKay. Soft cover, 5½in x 8¼in, 160 pages. Gernsback Library Book No. 84. Contains photographs and diagrams.

A reasonably non-technical publication, this book is intended as a guide for the pleasure boat owner regarding the types and makes of equipment available for shipboard use. It is an American book and quite a lot of commercial equipment mentioned would therefore be unobtainable in this country.

However, apart from this, the book would be quite handy as a non-technically worded explanation of marine electronic equipment. Besides dealing with radio transmitters and receivers aboard ship, it explains power supplies, depth sounders, direction finders and other navigational gear.

Thus, the owner of a small (or larger, for that matter) vessel would find this book useful as an indication of equipment which his boat could possess to advantage. This is because, in addition to explaining the principle of operation of various pieces of equipment, it gives the uses of the equipment and an idea of its worth in running a marine craft.

Our copy of the book was direct from the publishers and no Australian price was given. However, it probably will be available locally in due course. (J.R.)

★ ★ ★

FUNDAMENTALS OF TRANSISTOR PHYSICS, by Irving Gottlieb. Stiff paper cover, 143 pages, 5½in x 8¼in. Published 1960 by John F. Rider Inc. (No. 267).

Perhaps it was the title of this book, but I expected to find therein a mass of tables and graphs and formulas.

In fact, just the reverse is the case, the text being just as descriptive as it has been possible for the author to make it. Furthermore, it is designed to lead the student from a fairly average knowledge of radio valve physics and techniques to an adequate knowledge of semi-conductor devices.

As one might expect from this stated intention, the author makes free use of possible analogies between valves and transistors.

Beginning with a chapter on atomic physics, the book takes the reader through electrical conduction to transistor action and then to typical transistor structures.

It thereafter describes the basic behaviour of transistors in circuit without, however, attempting to present complete transistor equipment designs.

A final and useful chapter describes a variety of other semiconductor devices, including rectifiers of various types and the tunnel diode.

In short, it is a book which is readily readable by any keen enthusiast, yet basic enough to be of use to engineers wanting to catch up on semiconductor theory.

(Our copy from the publishers. Supplies should be available shortly through local technical booksellers.)—W.N.W.

★ ★ ★

TRANSISTOR THEORY AND CIRCUITS MADE SIMPLE, by Harvey Pollock. Stiff paper cover, 124 pages, 9in x 6in, published by the American Electronics Company.

Many text-books have been published in recent years dealing with transistors, but among those of the more elementary variety, this one is outstanding for its clarity of presentation. Fact follows fact in logical sequence and, while coverage of the subject may not be complete, what is given should form an excellent foundation for further study, if the need for this should arise.

The author, Harvey Pollock, is attached to the Forest Hills High School and the book was probably designed as a text for advanced students. The few mathematical expressions which do appear will not deter the average reader.

Beginning with an excellent chapter on background physics to semi-conductors, the author goes on to explain how transistors work, their characteristics and their application to basic amplifiers and oscillators.

This leads naturally into a discussion of typical transistor circuit applications, suitable for construction and experiment.

(Review copy from the Technical Book Co., 295-299 Swanston Street, Melbourne. Australian price 19/9, plus 1/ postage).—W.N.W.

★ ★ ★

BASICS OF GYROSCOPES, by Carl Machover. Stiff paper cover, 9in x 6in pages. Volume 1 (No. 257-1), 112 pp.; volume 2 (No. 257-2), 120 pp. Published in New York, 1960, by John F. Rider Inc.

Most popular science readers know what a gyroscope is and that it is used in various navigational and allied instruments. Few, however, would be able to go into much detail beyond that.

And, according to the author, such information is not too readily available, at a popular level, being largely distri-

STEREOPHONIC EQUIPMENT

POINTERS ON BUYING

BE CAREFUL OF YOUR FRIENDS

Your friend may have read a few more advertisements than you have. This does not make him an authority. Remain sceptical when he describes the X speaker as the only possible choice.

BE CAREFUL OF SPECIFICATIONS

One well-known speaker has a useful frequency range of 30-14,000 cycles in England and 20-24,000 cycles in America. One popular stereo cartridge has a frequency range of 40-12,000 cycles in England and 30-24,000 cycles in Australia.

DON'T BUY ON NAME ALONE

Remember, there is as much difference between an 8in and a 12in in some of the good speakers as there is between a G.-M. Holden and a G.-M. Cadillac.

DON'T SPEND TOO MUCH ON YOUR AMPLIFIER

Though there is a difference between a good and a superlative amplifier there is a far greater difference between a good and a superlative speaker.

DON'T TEST THE EQUIPMENT SOLELY ON DEMONSTRATION RECORDS

The number of persons who can tell the difference between a distorted and an undistorted train is very limited.

DON'T TRY TO BUY THE "BEST"

We don't know what it is and we have never met anyone who does. But with our wide knowledge of the equipment available and the music it is meant to reproduce we can help find what is best for YOU.

We DO ACCEPT TRADE-INS

Our cabinets will not appeal to those who consider ugliness is necessary for good reproduction. Our prices will disturb those who think good equipment must be fantastically expensive. But we feel that in each price range our value for money is impossible to beat.

ENCEL ELECTRONICS

354 & 361 Bridge Road, Richmond—JB2820

RING FOR A LISTENING APPOINTMENT DAY OR EVENING.

ACOS REPLACEMENT CRYSTAL CARTRIDGES

GP37-1C
Standard replacement crystal turnover Cartridge for most record changers. Now replaced by GP65-1G.
PRICE:
Twin Sapphire Styli, £2/18/6.
Sapphire/diamond Styli, £4/19/6.

GP67-1G
Crystal turnover Cartridge, standard ½" mounting bracket. Improved GP37 performance. Replaces GP65-1G.
PRICE:
Twin Sapphire Styli, £2/18/6.
Sapphire/diamond Styli, £4/19/6.

GP67-2G.
High gain turnover crystal Cartridge, suitable for reproducing standard and microgroove recordings with low gain amplifier.
PRICE: Twin Sapphire Styli, £2/3/-.
Sapphire/diamond Styli, £4/4/-.

GP61
Turnover ceramic Cartridge. Unaffected by heat or humidity. Specially designed for tropical areas.
PRICE:
Twin Sapphire Styli, £2/18/6.
Sapphire/diamond Styli, £4/19/6.

HGP39
Crystal Cartridge. Available for standard or L.P. recordings for use with HGP20 and HGP40 Pick-up Arms.
PRICE:
Single Sapphire Stylus, £3/12/6.
Single Diamond Stylus, £5/13/6.

ACOS STEREOPHONIC CARTRIDGES

GP73 Series
Turnover stereophonic Cartridge, plays all types of recordings. GP73-2 Medium output. GP73-5 High output. Available with standard ½" mounting bracket (type A), or special mounting bracket for end mounting (type B).
PRICE: Twin Sapphire styli, £3/6/-. Sapphire/diamond stylus, £7/13/6.

GP71 Series
Cartridge plays stereo and L.P. recordings, non-turnover type.
PRICES: GP71 with sapphire stylus, £3/6/-.
GP71 with diamond Styli, £5/16/6.

AUSTRALIAN AGENTS.

AMPLION (A/SIA) PTY. LTD. 101 Pyrmont Bridge Road, Camperdown, SYDNEY, N.S.W.

ted through weighty mathematical ct books or magazines covering this ecialised field.

The author has set out to bridge this p, in these two volumes, for the sake technical or sales personnel, who may involved in any way with gyroscopes d their applications. And he has gone a great deal of trouble.

About half the total space is occupied th illustrative drawings, representing an ormous amount of art work.

Volume 1 begins with an explanation the gyroscopic principle and the laws gyroscopics, leading naturally into ap-ications such as the directional gyro d the gyrocompass.

Volume 2 carries on into more com-icated applications of the gyroscope, th for earth navigation and for use space vehicles, etc. Some actual com-ercial gyroscopes are illustrated and plained.

In brief, these two books should be valuable acquisition for anyone wishing gain an insight into this specialised ld.

(Our copies came direct from the pub-her. Supplies should be available cally, in due course, from technical ooksellers.)—W.N.W.

★ ★ ★

TELEVISION EXPLAINED, by W. E. Miller, M.A. (Cantab.), M. Brit., I.R.E., and E. A. W. Spreadbury, M. Brit., I.R.E. Hard cover, 192 pages, 8¾in x 5½in; seventh edition, published in London, 1960.

The basic merit of this book is indi-ted by the fact that it has sold out x editions since 1947. This present lition has been somewhat revised and ought up-to-date by the addition of w material on combined television and M receivers.

In its presentation, the book assumes at the reader is familiar with ordinary dio terms and practice but knows noth-g of television. It avoids mathematics, lying on descriptive text to explain the peration of television receivers from rial system to picture tube and loud-eaker.

Unfortunately, however, the book is of nly limited use to Australian readers r two reasons:

(a) It is based almost entirely on Eng-sh practice and standards, with only assing reference to other systems.

(b) A lot of space is devoted to ob-lete practices and designs which would e found nowhere else but in England.

While, therefore, the book may be seful in Australia as a summary of the nglish system, it would be of very mited value otherwise.

(Review copy received direct from the ublishers.)—W.N.W.

★ ★ ★

RADAR, by T. J. Morgan, C.G.I.A., A.M.I.E.E. Hard cover, 144 pages, 7½in x 5in. Published in London, 1960, by Frederick Muller Ltd.

This new book is one of the "Mech-ical Age Library" series, with titles re-ased or projected covering many anches of applied science.

The opening chapters in the book aim enlighten the reader about electrons, electromagnetic radiation, the cathode ray tube and how the foregoing can be related to indicate time and distance.

From there on, the author traces the development of radar systems, particularly in England, and their contribution to ultimate victory in World War II.

This makes easy reading for anyone technically inclined, though an author of another nationality may have changed the emphasis somewhat!

The book concludes with several chapters on peacetime uses of radar, both actual and projected.

In short—medium to light reading of the technical kind. (Our copy from the publishers.)—W.N.W.

SAVE TIME, MONEY AND WORRY . . .

Send your METER AND INSTRUMENT REPAIRS direct to our service department for immediate reliable service.

FERRIER ELECTRICAL INSTRUMENTS
43 ALBANY ST., CROW'S NEST, N.S.W. JF 5596
FERRIER

U R D

hi-fi stereo specialists

U.R.D. specialise in High Fidelity Stereo equipment and stock all electrical appliances, radio and TV components and parts. Hear and compare the latest stereo players, amplifiers and speakers in our modern showrooms.

Axiette to the left!
Axiette to the right!

That is hi-fi stereo sound!

And what economy in space—full-size Bass Reflex Column Cabinet: 12" x 12" x 30" or 24" x 17" x 10", or a corner version, 27" x 27" x 15".

● Response: 40-15,000 c.p.s. ● Resonance: 65 c.p.s. ● Power: 7½ watts.

New cast housing gives outstanding performance in column cabinets.

A complete Wide-range Speaker for £16.

U R D
UNITED RADIO DISTRIBUTORS,
175 Phillip Street, Sydney. BW 3718, BW 3926.
Write, telephone or visit—you'll find the service prompt and the advice helpful at U.R.D.

AMATEUR BANDS WITH BILL MOORE

ZL FIRST IN ARRL DXC CONTEST

Among the various "clubs" which amateurs seem to form at the slightest excuse, the DXC Club of the ARRL is one which has fostered a lot of interest in recent months. Various contestants battled for the honour of working the magic figure of 300 countries; probably the last "100" mark to be passed for a long time.

DX provides an attraction for thousands of radio amateur operators. The hours spent in waiting for that elusive station on the other side of the world are relaxing and ultimately plenty of operating skill is required to make the contact.

The final race to the 300 country mark in the ARRL's DXC Club was won by Jock White, ZL2GX. Jock must be congratulated on attaining such a tally in face of the competition of "Californian Kilowatts," antenna farms and the like. Close by were Don Wallace, W6AM, and Chas. Mellon, W1FH.

Jock's 300th country was Campbell Island, south of New Zealand. ZL2GX is awards manager for the NZART and by profession is a schoolteacher. His record in the DX field down-under is unsurpassed. Bob White, W1WPO, ARRL DXC Club manager, reviewed Jock's effort in a Voice of America broadcast. Prewar, the leading DX exponents' country tallies ran in the vicinity of 150; in the last 15 years that total has been doubled. No one can accurately assess the exact country total for DX certificate purposes as political and DX-peditions ventures are likely to change the tally at any stage.

Progress above the 300 mark will be slow, as most excuses for the establishment of a new country have been well vented. Danny Weil, soon to venture across the Pacific, is making a review of the islands of that ocean with a view to providing a few new ones for DX enthusiasts and it will be mainly from journeys of this type that the ultimate tally can be increased.

Currently about 2,500 to 3,000 amateurs are actively engaged in improving their totals on DXC Club lists.

The FCC is shortly to introduce a new method of answering Amateur Operator Licence Examination questions. The purpose of the change is to reduce the time required for examination grading by the FCC field officer personnel.

The new arrangement is as follows and indicates the method used in the U.S. for theory and regulation examinations. T questions and their multiple choice a swers will in the future be printed the one sheet and a separate sheet is pr vided for the marking of the applican choice of the correct answer.

The papers provide spaces for 1 questions and answers. A 20 questi examination is set for novice cla licensees and 50 question examinati for technical, conditional and gener class licensees. On the answers she besides the number of questions are t letters A, B, C, D, E. The examin is required to put a pencil stroke unde neath the letter representing the answ he considers to be the correct one. A example is provided in the margin of t answer sheet and runs as follows:

EXAMPLE

Question—A kilocycle is: A, one cycl B, 100 cycles; C, 60 cycles; D, 1,000,00 cycles; E, 1,000 cycles. The strok would thus appear under the "E."

The scope of the questions under th new arrangement will only be modifie to a slight degree. Instead of requirin the examinee to draw diagrams multipl diagram questions will be provided. Fo example, the candidate should be pre pared to choose—the correct place t connect a neutralising capacity in a amplifier, the correct name of an oscilla tor circuit, the correct descriptive nam for an RF filter circuit, etc. The exam inee should have little trouble followin the examination arrangement. Actually the previous form of examination wa similarly arranged with a selection o answers. A set of five possible answe was provided and the main change were in the format of question and an swer sheets.

The Voice of America amateur radi programs, broadcast weekly, provid much information of interest to amateur throughout the world. The times of re ception, however, are not particularl suitable for listeners in VK. Sessions ar broadcast twice on Sundays and appea here at 0715 and 0815 hours EAST o Mondays. The program runs for 1 minutes and is transmitted on most o the short-wave broadcast bands beame to many parts of the world.

PERSONNEL

Bill Leonard, W2SKE, is the announcer, Gene Kern, W2BAK, produces while Bill Dullin, W4ETT, and George Jacobs, W3ASK, provide the propagation forecasts. Listeners to the session can obtain a special VOA QSL by writing to Amateur Radio, Box 922, Washington 4 D.C., U.S.A.

Old-timers' clubs have been established by a number of national amateur societies. For the really ancient amateur membership is available in the Old Old-timers' Club founded in 1947. Any amateur wireless operator who holds a valid amateur licence and who held a two-way contact over his or her own transmitter and did so make such transmissions with some other wireless station whether amateur, commercial or naval, at least forty

THE STORY OF AMATEUR RADIO

The planning committee of the ARRL have for some time been studying the possibility of presenting a story covering amateur radio in such a fashion as to make it appealing and interesting to the general public. The program was to take the form of a moving picture suitable for presentation over U.S. TV stations, as well as for distribution throughout the world to interested groups.

UNANIMOUS OPINION

It was the committee's unanimous opinion that the history of amateur radio could support many interesting and true stories to warrant prime television time with excellent chance of commercial sponsorship. Such a procedure would necessitate the use of professional writers and advertising agencies who were qualified to present such stories to interested sponsors.

Two well-known amateurs were co-opted. Bill Leonard, W2SKE, of Columbia Broadcasting System, best known for his amateur broadcasts over the Voice of America, and Ernest Lehman, K6DXK, one of the better known moving picture writers. Meetings have been held but it is apparent that further development of the project will have to be made before qualified personnel to act in an advisory capacity could be employed. The undertaking will take considerable money which it is hoped will eventually be underwritten by a sponsor. Until a story is developed it could not be presented for sponsorship.

Since the original discussions, the American Broadcasting Corporation presented in April "The Hams' Wide World" on TV, a program that was a documentary but did not cover the story of the dramatic development of the amateur service. It did provide excellent publicity for amateur radio via the TV medium. The feature was produced by Dave Bell, W8GUE, and Perry Klein, K3JTE, one of the "Satellite Bounce Team," described his news-making experiments. The guest amateur was Ed Krieg, W3CAY, who was featured complete with equipment, QSL cards, set up in the TV studio.

REPORT TABLED

At this stage the ARRL board had to decide whether it wanted to underwrite the initial expense of the program's preparation or whether it preferred additional programs of the type presented over the A.B.C. It was estimated that the initial cost of preparation would run anywhere between 5,000 and 25,000 dollars. The board at their 1960 meeting received the planning committee's report and in view of the need to conserve funds the report was tabled. Undoubtedly more will be heard of the project with its potentiality as a publicity medium and possible source of revenue.

ars prior to his or her application shall eligible for consideration for membership.

The applicant need not have been continuously active in the art during the ervening years. There are at present out 120 members. Applications should directed to the Secretary-Treasurer, rl C. Williams, W2EG, Box 462, Asry Park, N.J., U.S.A.

ANDLING CARDS

Some of the W's do sterling work in ting out the QSL-ing for some of the er DX stations. W2CTN is a case in int and has nearly a full-time job look- after the card chores for such a up as CN2BK, CR4AH, CR4AV, 4AX, FK8AI, FK8AT, FK8AW, 7WP, FM7WU, HR2FG, KW6CP, 6CU, ZS7M, JZzeroDA, JZzeroHA, 51G, OX3RH, TG9AL, TI2WD, 2FR, VK9GK, VK9NT, VR2DA, 2DK, VQ2EW, VQ3CF, VQ3HH, 2I, ZD2DCP and 9GIBQ. A good rt for a DXCC on their own.

The third semi-annual high speed code ts sponsored by the Connecticut Wire- s Association created great interest. sions were sent simultaneously on the , 7, 14 and 21 Mc. bands. A number amateurs qualified for high-speed code ficiency certificates. W5JPC and YZO made the grade at 60 w.p.m. 1 W4DLA at 55 w.p.m. Quite a number of amateurs qualified at "slow" speeds, 40 w.p.m. and above. Speed practice runs are presented weekly at speeds between 15 and 65 w.p.m.

WIAW, official ARRL station, also provides code runs for practice purposes up to 35 w.p.m. It can be heard daily at 1130 hours EAST. The best frequency for reception here is 21075 Kc/s.

The ARRL Board Meeting for 1960 brought many points of interest to the fore and some of the most important were mentioned in the August issue. The board comprises 14 directors elected by members in the various divisions, the president and two vice-presidents and the ARRL's general manager, the last three members having no vote. Special committes nominated by the board carry on functions of the organisation during the periods between board meetings.

FAR-REACHING EFFECTS

While most of the decisions reached cover domestic matters at times they can have far-reaching effects, as American amateurs are such a large portion of the total world amateur population. Matters discussed included a decision to press for reciprocal operating privileges for nationals of foreign governments. A proposal that RACES frequencies be arranged outside but close to the amateur bands was defeated. The board was in session for nearly eight hours and appropriations totalled 50,000 dollars.

DIVISIONAL NOTES & ACTIVITIES

The Postmaster-General, Mr David- t, announced on August 2 the mem- s of the Ad Hoc Committee that will iew the application of the proposed le of frequency allocations adopted the Geneva I.T.U. Conference. The t meeting is scheduled to take place August, but undoubtedly it will be ny months before the outcome of the iberations is made public.

The chairman is Professor L. G. H. xley, chairman of the Radio Research ard and Vice-Chancellor of the Aus- lian National University.

MEMBERS

The other nine members are: Mr R. B. ir, member of the Australian Broadting Control Board.

Mr Arthur Tinkler, VK3ZV, repreting the Wireless Institute of Aus- ia.

Mr W. W. Honor, chief of the A.W.A. search Laboratory, representing the io manufacturing industry.

Mr J. H. Williams, of the Royal Melrne Technical College, and Mr D. G. les, representing public utilities and mmercial organisations.

Mr H. White, Acting Director Airways gineering, D.C.A.

Group-Captain J. W. Reddrop, chair- n of the Joint Communications Comtee, Department of Defence.

Mr E. J. Stewart, supervising engineer tems planning), Engineering Division, t Office Headquarters, Melbourne. Stewart was leader of the Australian gation to the Geneva Conference in 9.)

Mr H. W. Hyett, supervising engineer, io, Engineering Division, Post Office Headquarters, Melbourne.

The committee will consider the application of the table in light of the present usage of frequencies in Australia. They will also examine any radio frequency matters arising from reports to the P.M.G. by the Broadcasting Control Board on broadcasting and TV.

It will study too the manner of any additional distribution of available radio frequencies "in the overall national interest."

The July meeting of the N.S.W. Division, the first held at Administration Headquarters, was well attended, nearly 100 members arriving at the new venue. Two extremely informative lectures were presented, the first by Leon Parr-Smith, VK2AOJ, who spoke of oscillators, their operation and design. Leon covered VFO's and the most effective types for amateur use. Leo McMahon, VK2AC, followed and covered receivers and the need for stability for use in crowded amateur bands.

WELL RECEIVED

The use of crystal converters and other means of receiving signals free from interference was also covered. Both lectures were of the type most appreciated by amateurs and very well received.

Next AOCP course to be conducted by the N.S.W. Division of the W.I.A., will commence about February of next year. The correspondence course, however, runs continuously. The course of 48 lessons covers theory and regulations and inquiries re the course should be directed to the Secretary, N.S.W. Division, 14 Atchison Street, Crow's Nest.

Lecturer at the July meeting of the Hunter Branch of the N.S.W. Division was Harold Burtoft, VK2AAH, and covered a "Transistor, Mobile Modulator," a lecture of topical interest. State President, Bill Lewis, VK2YB, journeyed with Harold to the meeting and both visited the local shacks on the following day enjoying Newcastle hospitality.

Future plans for the N.S.W. Division's Administrative H.Q.'s were discussed at the July meeting of the division. It was resolved that council obtain plans for extensions up to the value of £4,000 to provide space for disposal equipment and other activity.

Alterations by voluntary efforts permitted the holding of the general meeting there during July.

MORSE PRACTICE

Slow morse practice is now available at H.Q. on several evenings per week, a value adjunct to the nightly sessions on 3.5 Mc/s. These sessions are broadcast on 3525 Kc/s. at 1930 EAST every evening with morse speeds between 5 and 15 w.p.m. Amateurs throughout the State provide the service taking their turn on the roster.

The callsign VK2AWI is used and after each speed transmission the text is read back on telephony allowing an immediate check. The sessions provided by amateurs are a valuable service to enthusiasts and Max Sowels, VK2OT is coordinating the practices on behalf of the division.

OTHER SOURCES

Another source of morse practice for beginners is the daily transmissions from New Zealand station ZKF. They are provided from 1630 to 1800 hrs. EAST on 6885 and 3324 Kc/s.

Morse speed commences at 5 w.p.m. On the first Monday of each month at 1900 hours EAST a speed transmission is made between 15 and 30 words per

RADIO FOR AMATEURS

Course especially designed for Correspondence instruction . . . profusely illustrated . . . clearly written. The Stott method of teaching is the simplest that can be devised.

YOU can learn in your own home to design and build Radio Receivers.

Note this student's comment:

"Before I took your Course, I knew practically nothing about the subject. On completion of your Course, I was capable of fault-tracing and repairing, and I understand the principle of operation of modern receivers and their components as well."

The Course includes lessons on Transistors.

Stott's Correspondence College

159 Flinders Lane, Melbourne; 149 Castlereagh St., Sydney; 290 Adelaide St., Brisbane; 21 Grenfell St., Adelaide; 254 Murray St., Perth.

CUT HERE AND POST

TO STOTT'S: Please send me, free and without obligation, full particulars of your Course in Radio for Amateurs.

My Name .....

Address .....

..... Age ..... (R.H.960)

Highest quality TRANSCRIPTION DIAMOND

FOR ONLY

£4 each

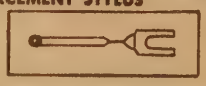
METRO-SOUND

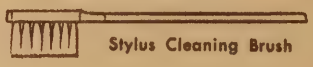
MASTER POINT DIAMOND STYLI

For faithful reproduction . . . for longer playing hours and greater protection of cherished discs, use the new Metro-Sound Diamond Styli available now for only £4 each. There's a complete range to fit all pick-ups and cartridges . . . for stereo as well as monaural discs, available from all leading record suppliers. Trade enquiries to sole Australian agents:

List No. M.L6 — For B.S.R. T.C.8M., and
Diamond Point — T.C.8H.
33⅓-45 R.P.M.

THIS IS A METRO-SOUND "MASTER POINT" REPLACEMENT STYLUS





Stylus Cleaning Brush

LEO ROGALY AND LEWIS PTY. LIMITED
35 Bathurst Street, Sydney. 61-6607

Interstate Representatives:
Qld.: T. A. Ferry, 77 Queen Stree
Vic.: R. Feldmann, 163 Swanston Stree
W.A.: D. B. Sharp, 49 St. George's Terrac

FI-CORD

Fidelity Miniature Tape Recorder

Lightweight • Transistorised
Rechargeable batteries • 2 speeds

On business or pleasure, for interviews or dictation, Fi-Cord will faithfully record your ideas, your notes, your sound memories.

And Fi-Cord's sound quality is well up to broadcast standards. Photo at left shows GTV-9 personality Panda using Fi-Cord to interview actress Maureen O'Hara in Hollywood for subsequent broadcast over Channel 9.

FI-CORD is the world's only miniature tape recorder priced for the domestic market, yet precision-built for professional use.

Available from all progressive Tape Recorder Dealers

Australian National Distributors:
Simon Gray Pty. Ltd.
28 Elizabeth Street, Melbourne
Telephones: MF8166, MF8211

nute. Awards for original copy—one nute 100 per cent out of a three min- period will be acknowledged. In- iries should be directed to ZL1HQ.

The Hunter branch's annual dinner d field day is again scheduled to take ace over the Six-hour Day holiday ekend in October. The venue of the ner is the Newcastle College of the iversity of N.S.W. at Tighe's Hill, and l be held on Saturday evening, Octo- 1st. Guest speaker for the evening ll be the Federal President of the I.A., Max Hull, VK3ZS. On the fol- ving day the well-known Blackalls ld Day will be the attraction.

Two other events scheduled for the ne holiday weekend are the N.S.W. HF Spring Field Day and W.I.A.'s uth-western Zone's Convention. The S.W. VHF and TV Sections Field Day ll be held on Sunday, October 2nd, th emphasis on long distance 144 c/s. working. Barry Goodman, K2ZAG, or Dave Andrews, VK2AWZ, uld be pleased to hear from N.S.W. untry 144 Mc/s. operators on their pposed participation in the event. The uth-western Zone rotate the location their annual convention and this year agga has been selected. Details of the nt will be publicised over VK2WI.

ISPOSALS COMMITTEE

The new Disposals Committee of the S.W. Division comprises Keith King, K2ABK, chairman of the Blue Moun- ns section as purchasing officer, Norm ard, VK2ALJ, N.S.W. Secretary, Ad- nistration, and Barney Smythe, Distri- tion. It is hoped to procure a good al of equipment for members and a nsiderable amount has already been tained.

Lecturer for the September meeting the N.S.W. VHF and TV Section to held on September 2, at the Admin- ration Building, Crow's Nest, will be ex Slight, VK2ZA, who will talk on ifting the frequency of crystals.

World activity on 50 Mc/s., despite e sunspot decline, is quite high. It is ll over a year since the peak of cycle was passed. At the beginning of the cle in April, 1954, the sunspot number is 3, which rose to a peak in 1958 of 1, and has now dropped to below the 0 mark. Japan provides the most in- esting contacts with VK. As well as e JA's some 10 KA's are active on e band, but are permitted to use fre- encies above 50.35 Mc/s. only.

As well as VK's in recent months L7, KH6, KG6, ZL and DU have been ard. The 4,000-mile TE path to Aus- lia has been particularly consistent.

ARGE TALLIES

North and South America contacts are ll being regularly made. Some of the J's have prodigious tallies of W sta- ns worked during 1960. LU3EX, for stance, has contacted 31 different KP4's ne. Another well-known TE path m ZE2JV Southern Rhodesia and 4WR in Cyprus is open consistently th contacts being established practi- lly every day.

Little is known of how TE propagation s in with solar activity and records amateur DX working via this medium uld provide valuable information.

Although the ARRL Propagation Re- rch Development Scheme is officially concluded, there is still a need for the collection of data on VHF DX working and any reports would be appreciated by the League.

The G's have extended their 70 Mc. band record a little further with a con- tact between G5MR and CN8MG over a 1,300-mile range. Signals both ways at S8 to S9. Stations in the U.K. have too been making many contacts on 144 Mc/s. via the Aurora. Following the 27 to 29 day peaks distances up to 600 miles are covered regularly.

Perc Heally, VK2APQ, is anxious to make contact with stations in the south and south-east of the State on 144 Mc/s. With a clear sight of the Gib at Bowral Perc beams a signal in that direction from 2000 hours EAST on Monday and Wednesday evenings. He will use either 40 or 80 metres for liaison purposes. A number of stations are active in that area of State, including VK1VP Can- berra, VK2PN Tumut, VK2ZAA Tumut, VK2ZES Muttama, VK2ZBP Illabo, VK2ZEC Leeton, VK2AJO Coolamon, VK2ZEA Holbrook, VK2ZLS and VK2ZHW in Wagga. They look towards Sydney most evenings for five minutes commencing at 2000 hours EAST.

MONTHLY NEWSLETTER

With the boating weather now upon us we felt we could not let this opportunity go without showing you photographs of the runabout in which we test our small boat marine equipment. The boat shown here is equipped with a Radio Direction Finder, Echo Sounder, Gas Detector, Bilge Level Indicator, Electronic Tachometer, Transistor Communications Receiver, Electric Bilge Pump, Siren and many other accessories, all of which we can supply direct to small boat users. We also welcome enquiries in this direc- tion from trade suppliers.

The trailer is equipped with an Electric Power Winch which makes "Loading a Cinch with Power Winch." (Yes, that's the slogan.)

In the hi-fi department we have new stocks of Grado pickup cartridges and Audio Empire arms, both of which have been in short supply lately, and a new consignment of Fisher amplifiers and tuners has now arrived.

A line which has also been in great demand is the Ortofon pickup arm, type SSM-212, with a "G" type pickup shell. This is a fully adjustable arm with micrometer weight adjustment and with the arm priced at £19/14/- retail, places within the reach of everybody an extremely high quality piece of equipment, which will accept any standard "C" type cart- ridge with the added advantage of accepting standard Ortofon heads.

In some cases it may require remounting of the heads because the plug-in shell has an optional three or four-pin connection, making it very versatile and popular. We thoroughly recommend this arm to anyone seeking a new stereo pickup.

Supplies of the fabulous Ortofon stereo head, which has won world acclaim for its magnificent technical features, are once more readily available. This remarkable head is priced at £34/5/- retail and would really complement any existing stereo equipment.

Well, that is all for this month and we look forward to being of service to you all.

Yours faithfully,

STAFF.

UNITED ELECTRONICS (A/SIA) PTY. LTD.

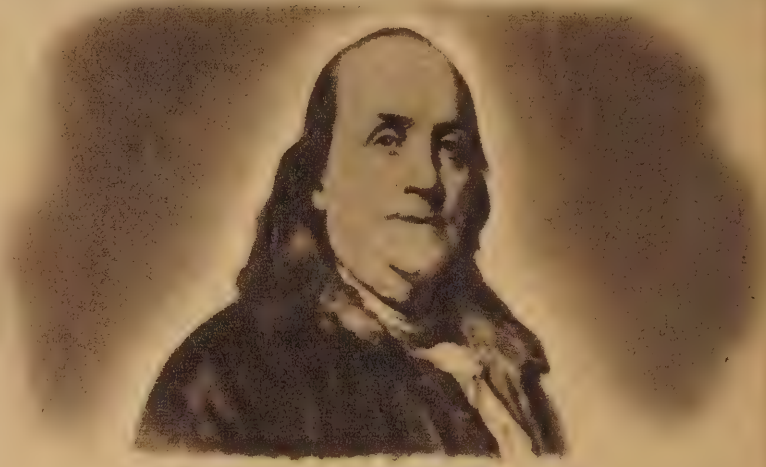
31-33 CAMBERWELL ROAD,

CAMBERWELL JUNCTION **Phone: WB 3333**

WHAT SECRET POWER DID THIS MAN POSSESS

WHY was this man great? How does anyone—man or woman—achieve greatness? Is it not by mastery of the powers within ourselves?

Know the mysterious world within you! Attune yourself to the wisdom of the ages! Grasp the inner power of your mind! Learn the secrets of a full and peaceful life! Benjamin Franklin — like many other learned and great men and women—was a Rosicrucian. The Rosicrucians (NOT a religious organization) first came to America in 1694. Today, headquarters of the Rosicrucians send over seven million pieces of mail annually to all parts of the world.



Benjamin Franklin (A Rosicrucian)

THIS BOOK FREE!

Write for YOUR FREE COPY of "The Mastery of Life."—TODAY. No obligation. No salesmen. A non-profit organization. Address: Scribe W.D.J.

The
ROSICRUCIANS
(AMORC)
BOX 3988, G.P.O., SYDNEY
AUSTRALIA

SEND THIS COUPON

Scribe W.D.J.
The ROSICRUCIANS (AMORC)
BOX 3988, G.P.O., SYDNEY, AUSTRALIA

Please send me the *free* book, *The Mastery of Life*, which explains how I may learn to use my faculties and powers of mind.

NAME_____

ADDRESS_____

_____ STATE_____

for reliability, durability, quality, specify . . . .

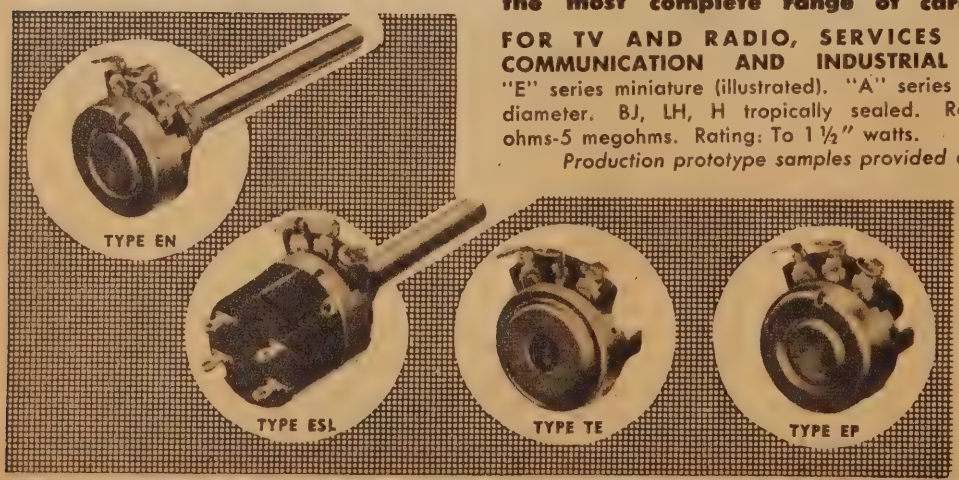
MORGANITE CARBON POTENTIOMETERS

the most complete range of carbon controls

FOR TV AND RADIO, SERVICES EQUIPMENT, COMMUNICATION AND INDUSTRIAL ELECTRONICS

"E" series miniature (illustrated). "A" series standard—1 ⅛" diameter. BJ, LH, H tropically sealed. Resistance: 1,000 ohms-5 megohms. Rating: To 1 ½" watts.

Production prototype samples provided on request.



SPECIFY ALSO MORGANITE *Insulated* **COMPOSITION RESISTORS**

Type "AS": ½ watt, $\frac{5}{32}$" x ⅜" long.

Type "AY": 1 watt, $\frac{7}{32}$" x ¾" long.

MC45

Morganite Australia Pty. Limited.

HEAD OFFICE:
65-67 BOURKE ROAD, ALEXANDRIA, N.S.W. PHONE: 67-1371. TELEGRAMS: "MORGANITE," SYDNEY.
117 THISTLETHWAITE STREET, SOUTH MELBOURNE, SC.5, VICTORIA. PHONE: 69-6106. TELEGRAMS: "CRUCIBLE," MELBOURNE.

CALL, WRITE OR 'PHONE FOR CATALOGUE TO-DAY

ON SHORTWAVE BY ART CUSHEN

'U PLAN COMES INTO OPERATION

The recent International Telecommunications Union Conference in Geneva formulated a plan for short-wave transmission which is now being adopted.

HE new plan is designed to give the maximum use of short-wave frencies to short-wave broadcasters, ie of whom will have to alter transsions so as to broadcast when the ticular frequency assigned to them is being used. This idea will minimise rference between stations which use same frequencies, and should do ch to improve the standard of shorte signals. The plan is put into effect h three months of the year as stations r frequencies for summer, autumn, ter and spring broadcasting schedules. e new Voice of Denmark schedule, ch comes into effect this month, finds station using its 9520 and 15165 Kc nnels, with some time alterations to imise the interference to it and other ion's signals.

The new schedule is as follows:

NORTH AMERICA: 11.30 a.m. to 30 p.m. on 9520 Kc; 1.00 to 2.00 . on 9520 Kc.

SOUTH AMERICAN SERVICE: 8.30 9.30 a.m. on 15165 Kc.

FAR EAST, AUSTRALIA AND W ZEALAND: 7.00 to 8.00 p.m. on 65 Kc.

SOUTH ASIA: 12.30 to 1.30 a.m. on 65 Kc.

AFRICA and MIDDLE EAST: 2.40 3.40 a.m. on 15165 Kc.

In addition, the Danish Home Service m Copenhagen is broadcast to Africa and the Middle East daily from 3.40 to 7.15 a.m. on 15165 Kc.

Solomons signals

SIGNALS from the Solomon Islands Broadcasting Service on station VQO2 using 5960 Kc are reported by Michael Uibo of Eastwood, N.S.W. Signals are reported at Michael's location from sign on at 6.55 p.m. to 9.40 p.m. The station is heard with news at 7.15 p.m., which is relayed by Solomons from the B.B.C. in London. The Honiara station carries the same programs on VQO2 on 5960 as are broadcast on VQO on 1030 Kc.

Jesselton now on 5980 Kc.

THE broadcasts of "Radio Sabah" at Jesselton in North Borneo have been heard of late on several new frequencies, but transmission now seems settled on 5980 Kc. The station has English programs from 9.00 to 9.15 p.m. and again from 10.30 p.m. to midnight. The station was previously on 4970 Kc, and prior to that for many years was in the 41-metre band using 7170 Kc.

Broadcasts from Rabat

MOROCCO now operates some transmitters which, previously, were broadcasting from Tangier, and has an extensive schedule. The transmitters are indicated by SA (Sebaa Aioun) and T (Tangier). Program A, to West Africa in Arabic, from 4.30 to 9.00 p.m. on 6190 Kc, SA 50 Kw., 10.00 p.m. to 1.00 a.m. on 11735 Kc T-50 Kw., and on 15345 Kc. SA-50 Kw., 4.00 to 10.00 a.m. on 9506 T-50Kw, and 6.30 to 9.30 a.m. on 11735 Kc. T-50Kw. English is broadcast from 4.00 to 4.30 a.m., and French 4.30 to 6.30 a.m. Program B to Middle East in Arabic from 4.00 to 7.00 a.m., 9700 Kc. T-100Kw. Program C to South Morocco, 4.30 to 8.00 p.m., 10.00 p.m. to 1.00 a.m., and 4.00 to 10.00 a.m. on 7115 Kc. SA 10-Kw and 7225 Kc. SA-10Kw. Foreign languages are carried as follows, English 10.00 p.m. to 10.30 p.m. and 4.00 to 4.30 a.m., French 4.45 to 6.30 p.m., 10.30 p.m. to midnight, 4.00 to 9.00 a.m., Spanish 6.30 to 7.00 p.m., midnight to 1.00 a.m., and 9.00 to 10.00 a.m.

Kuwait on 4967 Kc.

THE recent frequency change of the Persian Gulf station at Kuwait from 5000 Kc. to 4967 Kc. has resulted in much better reception. The station has been received with its usual Arabic programs to 7.00 a.m., and then follows a news bulletin in Arabic usually by a woman speaker, and the station signs with a march at 7.08 a.m. Verification is now being issued in the form of a card from Kuwait, confirming the reception of its broadcasts. The Kuwait Broadcasting Service. Kuwait, is the address, and the station has a full schedule of broadcasts from 2.00 a.m. to 7.07 a.m. with 5Kw on the frequency of 4967 Kc.

PARIS IN ENGLISH

RECEPTION of news bulletins and programs in English from Paris, France, is a rare event these days and we look on Radio Paris as one of the poorest in the service it gives to English-speaking listeners The present broadcast for listeners in the United Kingdom is at the moment very well received on the new frequency of 5980 Kc. The station is on this frequency from 6.00 to 7.00 a.m., the final part of the broadcast being a news bulletin. The program, "The French Have a Word For It," which consists of English-French lessons, is included, and this is repeated at 5.45 p.m. on 7240 Kc.

Radiodiffusion Television Francaise broadcasts as follows:

Time	Frequencies	Area served
11.30-11.45 a.m.	11920	Reunion
4.00-4.45 p.m.	7280, 9560, 21580	Oceania
4.50-5.50 p.m.	11785, 17765, 21580	Africa
5.30-6.00 p.m.	9755	Antarctica
8.30-9.00 p.m.	21580, 21620	Antilles
10.15-10.45 p.m.	21580, 21620	Equatorial Africa
11.00 p.m.-1.00 a.m.	17765, 21620	Vietnam
2.00-2.30 a.m.	17765, 21620	Madagascar
2.30-4.00 a.m.	11845, 17765	Near East
2.30-3.30 a.m.	21620	Near East
3.30-3.45 a.m.	17850, 21580	Canada
6.00-7.00 a.m.	5955, 7160	Balkans
6.00-7.00 a.m.	9755	Balkans
6.00-7.00 a.m.	15160, 17765, 17850	Africa
9.00-9.30 a.m.	11920, 15295	Vietnam
9.30-11.00 a.m.	11920, 15295	Antilles

These are the broadcasts in French from Paris, other services in foreign anguages are broadcast to various parts of the world, with the only English ransmissions as stated above.

Flashes from Everywhere

INDIAN station Radio Srinagar, in Kashmir, has been listed on the schedule on 6115 Kc, from 10.00 p.m. to 11.05 p.m., and on 4860 Kc. 11.20 p.m. to 3.30 a.m. A new home service program called "Vividh Bharati" (All India Variety Program) is on the air from 11.30 a.m. to 1.30 p.m. on 7130 Kc., 9690 Kc., 2.45 to 4.30 p.m. on 11730, 11900 Kc., 9.00 p.m. to 10.45 p.m. on 11850; 11.00 p.m. to 2.15 a.m. on 9550, 9735 Kc., 2.30 to 3.30 a.m. on Sunday on 5990 Kc., 5955, 7155 Kc. A service to the Forces is on 4960 and 9705 Kc. A special service to the Maldive Islands is on the air on Saturday from 7.00 to 7.30 p.m. on 17705, 21620 Kc.

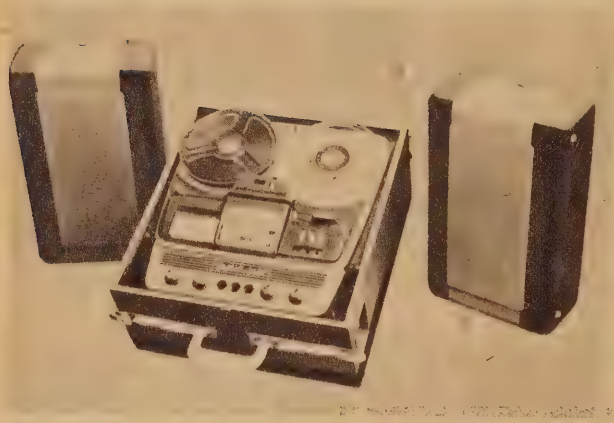
BERLIN, in the broadcasts from East Germany, has now a service to Africa, and the program of Berlin International is in French and English. This transmission is on 12080 Kc., English from 2.45 to 3.15 a.m. and French from 3.15 to 3.45 a.m.

STOCKHOLM has been heard in the broadcasts of Radio Sweden with special transmission in German and English for tourists. This program is carried on the short-wave transmitter at Horby on 6065 Kc. with 100 Kw. The program is on

GRUNDIG T.K. 60 (Mark 2)
STEREO MODEL TAPE RECORDER

GRUNDIG

NEW RELEASE



a big reduction in the oversea's price enables us offer it at the SENSATIONALLY NEW LOW PRI OF

£295

Fully Sterephonic Tape Recorders including 2 L Speakers for recording and play back as well as monaural operation. 2 Speeds — 7½ and 3¾in per secc Frequency response 40,000 to 18,000 c.p.s.

- Home Demonstrations in Sydney Metropolitan A may be arranged.
- We will Trade-in any Tape Recorder on one of t fabulous machines.
- We hire Tape Recorders.
- **PRE-RECORDED TAPE**

Our new Library of Pre-Recorded Tapes will be avail shortly. Send for Catalogue and Order Form.

387 GEORGE ST. (2 doors from Kodak). BX4440, BX4587

Magnetic Sound INDUSTRIES

AGN

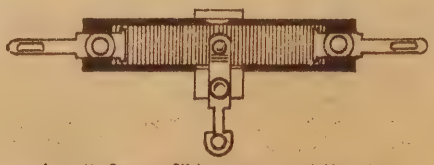
PRECISION WIRE-WOUND POTENTIOMETERS

CHOSEN FOR THEIR PERFORMANCE AND RELIBILITY
by discriminating engineers in every field

USED BY:

- Radio and Television Manufacturers
- Laboratory Equipment
- Electronics
- Universities
- Test Equipment
- Defence Services
- C.S.I.R.O.
- P.M.G., etc.

COMPARE — AND YOU TOO WILL CHOOSE A.G.N. PRECISION WIRE-WOUND POTENTIOMETERS

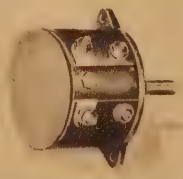


1 watt Pre-set Slider type, to 3,000 ohms, slab wound on former 1½in x 5/16in.

5 watt Semi enclosed 2 mounting lugs at 2¼in centres. Size 2in x 1½in, insulated shaft. Overal resistance tolerance within 5 per cent. Specials to 2 per cent. Linearity within 1 per cent. A robust and durable potentiometer from 5 ohms to 500,000 ohms. 10-1 vernier reduction drive optional extra.

2 watt Totally enclosed single 3/8in hole mounting, body moulded in high impact Polyethylene 1¼in. diam. x ¾in. 5 ohms to 100,000 ohms, 5 per cent tolerance overall resistance. 2 per cent linearity. Insulated shaft.

10 watt Totally enclosed. 2 tapped mounting holes at 2 7/8in centres. Size 4in x 1¾in. Insulated shaft. Overall resistance tolerance 5 per cent. Specials to 2 per cent. Linearity within .5 per cent. Very suitable for laboratory or accurate instrument applications. From 5 ohms to 1 megohm. 10-1 reduction vernier drive optional extra.



FROM RADIO SUPPLY HOUSES EVERYWHERE

Manufactured by A. G. NAUNTON & CO., 4 Hamlet Street, Cheltenham, Victoria.

Distributed by WATKIN WYNNE PTY. LIMITED, 21 Falcon Street, Crow's Nest, N.S.W.

Vic.: Radio Parts Pty. Ltd., Spencer Street, Melbourne. Qld.: Rollo T. Williams Pty. Ltd., 37 Tribune Street, South Brisban
S.A.: W. E. Beveridge, Cross Roads, Unley Park. W.A.: D. K. Northover, 115 Murray Street, Perth.

air from 5.15 to 5.30 p.m. in Ger- and from 5.30 to 5.45 p.m. in Eng-

AIRO Radio has appeared on 12030 announced as 11990 Kc., with trans- ions to Europe. A new relay of the o Home program has been noted 4765 Kc. from 6.00 to 7.00 a.m.

IBERIAN station ELWA, at Mon- a, has been heard from 12.05 a.m. 15080 Kc., with high power trans- ers, and the programs are directed rench-speaking areas of Africa. The il religious broadcasts are transmit- English is carried to 1.00 a.m., then minutes in Swahili and then in nch. The station operates to 2.00 . in French and then carries the smission to 4.00 a.m. in African dia- . The station closes with announce- ts in French and English and leaves air with the Liberian National An- n.

IAURITIUS station at Forrest Side, g 3325 Kc., has given good recep- in South Africa from 12.45 a.m. to off at 3.30 a.m.

HANA from Accra is heard on 4915 from 3.30 a.m. and is at its best r the closing of the Southern Rhode- station at Salisbury, which broad- s on a nearby channel. Signals are after 7.00 a.m., and all announce- its are in English, but at times also African dialects. The station identi- as "This is Radio Ghana, Accra," "This is the National Service of the na Broadcasting Service."

Notes from readers should be sent Arthur Cushen, 212 Earn Street, vercargill, N.Z. All times are Aus- alian Eastern Standard Time.

ENEZUELAN station YVLK Radio nbos is in Caracas, and is reported n North America as moving from 0 Kc. to 11970 Kc. The station has n heard from sign-on at 8.30 p.m. after 4 p.m.

OA's long-heralded short-wave trans- sion with 50 Kw. is now on the air test transmission prior to its use in Commercial Service of Radio Goa. station is now operating on 15385 17835 Kc., directed to the Persian f and Far East respectively. The mal broadcasting hours of Goa are n 11.30 a.m. to 3.30 p.m. on 4850 9690 Kc., from 4.00 to 7.00 p.m. from 9.00 p.m. to 3.30 a.m. on 4850, 0 Kc. Programs in English are car- at 4.30 p.m. and at 12.30 a.m.

ICARAGUA is reported by the ld Radio Handbook to have new ons on the air. These include YNX io Ewuos at Managua on 6025 Kc. 3000 W. YNJM Radio Norte at oto, on 6200 Kc., has the power to 0 W.

AOS is to step up its short-wave smission with a new 10 Kw. transmit- and reports from Japan say this smitter is now being tested in prepar- n for use in the Radio Laos broad- s. Broadcasts on 6150 and 7230 Kc. on the air from 5.00 to 8.00 a.m. ouncements are made in English and ch during this test.

UENOS AIRES has transferred its dcasts to Europe from 15345 to 0 Kc. The broadcasts are on the from 5.00 to 10.00 a.m., and the last is in English, but considerable in- rence is caused by the Radio Neder- lands transmissions on the same frequency.

MALI in West Africa with broadcasts from Dakar has been noted in Japan on 15385 Kc. from 6.00 a.m., also carries the same program on 11895, 7210 and 4955 Kc. English news is at 6.30 a.m.

TAIWAN station Radio Revival, BEH22, is now on 15478 Kc. and is on the air from 6.50 p.m. to 2.50 a.m. with religious broadcasts.

RUANDA-URUNDI is a new short-wave country to listen for and Radio Usumbura is reported to have commenced operations on 6195 Kc. with 2 Kw. No schedule is yet known for this station, which is in the Trust territory of the former Belgian Congo.

LAOS station Radio Seno, formerly on 7350 Kc., has moved to 6450 Kc., and is on the air on Tuesday, Thursday and Saturdays from 11.30 p.m. to 1.00 a.m., and is operated by the French with talks and request recordings.

VIETNAM, with broadcasts from Saigon, is reported to be testing soon two new transmitters, on 4810 and 11950 Kc., and a new short-wave outlet, which relays the programs in Nhatrang, on 9720 Kc. with 400 watts.

GHANA in its broadcasts from Accra has made some changes to its schedule on the frequency of 9640 Kc. This transmitter is now in operation Monday to Saturday from 10.00 p.m. to 2.15 a.m., and on Sundays from 3.30 p.m. to 8.15 a.m. on Monday. The other program of the Ghana Broadcasting Service has been noted on 4915 and 3365 Kc., with news relays at 4.00 p.m. and 6.00 a.m.

PERUVIAN station Radio Nacional in Lima has been noted in the United States in its International service in English from 9.00 to 10.00 a.m. This program is on the air from this hour on Tuesday, Thursday and Saturday, and this English transmission has been tuned on 15150 Kc.

INDONESIA has made some call-sign changes in its overseas services. The stations affected are, 9865 Kc, which has now the call-sign YDF6, and 11785 Kc., which is now YDD.

COLOMBIAN station Radio Bucaranganga, station HJGF, has English announcements during its transmissions on 4845 Kc. The transmissions are heard on this frequency from sign on at 9.00 p.m. to sign off at 2.00 p.m. next day, and relays HJGE on 1130 Kc.

VUNC, "The Voice of the United Nations Command," over stations of the Broadcasting Corporation of Japan, has recently ceased transmissions. VUNC was carried on two short-wave frequencies from Japan, namely 9560 and 6015 Kc, as well as several broadcast band transmitters. VUNC is also based in Korea with short-wave programs carried on its own and Korean Broadcasting System stations, and it is presumed that this network, which broadcasts in Chinese and Korean, is still operating. The reason for the closure of the VUNC programs from Japan (after the recent American-Japanese Treaty) is that NHK now has no duty to lend their transmitters. From June 27 VUNC stopped their activities in Japan, after beginning broadcasts in June, 1950, at the time of the Korean War.

STEREO TAPE HEADS!! NOW AVAILABLE!!

These Heads consist of a matched pair of stacked half track record-play elements within the one standard case, the same case as the Ultron series.

Pre-aligned, in-line gaps of extreme accuracy (.00016 in. gap spacers, alignment is so exact that the outputs of both tracks are fully in phase up to 20 kc.)

Overall separation is better than—45dB. Playback separation—53dB.

TWO INCOMPARABLE MODELS:—

Type TD extended range, each track same as Ultron 1ST.
Type HD extreme range, each track same as Ultron 1SHT.

THESE HEADS ARE BUILT TO THE SAME HIGH STANDARDS THAT HAVE MADE L.B. PRODUCTS TAPE HEADS LEADERS IN THE FIELD FOR A DECADE

Used by Govt. Depts., Universities, Research Depts., Tape Recorder Manufacturers, Telephone Companies, etc., and are fully guaranteed for one year.

RETAIL PRICE LIST

Type TD and HD (Stereo) £17/12/

Ultron 1S, 1ST, 1SL (Record-play high impedance, extended range, .00016in gap) **£9/13/6**

Ultron 1SH, 1SHT, 1SHL (Medium impedance extreme range, .00016in gap) .. **£9/13/6**

Ultron 1SS, 1SST, 1SSL (High efficiency record .00025in gap) **£9/13/6**

HE2, HE2T (Record-play, commercial quality .0002in gap) **£6/3/**

EU, EUT, EUL (High efficiency erase) **£5/7/**

H4 (Record-play) and EH4 (Erase) Miniatures .0002in gap **£5/2/**

Note: "T" denotes upper half track, "L" lower half track, all others full track (except H4 and EH4, which are half track).

SEND 4/ Postal Note for a copy of MAGNETIC TAPE HEADS, containing full details of all heads, including Stereo, High Fidelity Circuits, hints to builders, etc. A FREE COPY WITH EVERY HEAD. Copies also at Technical Book Co., Swanston Street, Melbourne.

Available from Homecrafts Ltd., 290 Lonsdale St., MELBOURNE.
A. G. Healing Ltd., 376-400 King William St., ADELAIDE.
A. E. Harrold Ltd., 123-125 Charlotte St., BRISBANE.

Manufactured solely by:

L. B. PRODUCTS

95 McDonald Street, MORDIALLOC, S.12, VICTORIA. XY1596.

ORDERS BY MAIL PROMPTLY SUPPLIED. Send cheque or money order for immediate service. All heads guaranteed for 12 months. Specify if required for "Tecnicorda."

ANSWERS TO CORRESPONDENTS

A.D. (Epping, N.S.W.) sends us a query referring to pickups for use in the "Answer Tom" pages of the magazine.

A.: Many thanks for the query, A.D., and we will file it for possible future use in the "Answer Tom" section of the magazine.

E.F.F. (Glenorchy, Tas.) writes to thank us for some previous advice and to suggest some references which may be useful in the "AC versus DC" discussion. He also comments on the matter of air-conditioners.

A.: Many thanks for your letter, E.F.F., and we are glad to learn that you have found our advice helpful. Many thanks also for the reference to electric shock and the suggestion regarding the air-conditioner. We have no exact details of the type you mention, although we are aware that this system is used. In any case, we will keep the idea in mind.

D.W.B. (Cambridge, N.Z.) sends in a contribution for the "Reader Built It" page.

A.: Thanks for your letter and the contribution. We may be able to use it shortly.

DC (Forbes, N.S.W.) sends us the circuit for a two transistor receiver constructed by himself, and suggests that we may include it in the magazine for the benefit of readers.

A.: Many thanks for the circuit, D.C., and we will file it for possible future use in the "Reader Built It" section of the magazine.

W.F.L. (Punchbowl, N.S.W.) has built the 1958 TV receiver, but is troubled by both sound and picture failure when the contrast control is advanced.

A.: It is difficult to diagnose troubles of this nature at a distance, W.F.L., but we suggest that the video amplifier is probably unstable and goes into oscillation when the contrast control is advanced. This could be due to a poor layout, or a failure of the 8 mfd screen by-pass, to suggest two of the most obvious causes.

D.B. (Byron Bay, N.S.W.) writes to inquire in which issues certain articles appeared.

A.: There are a number of our projects which might suit you, but the following references should help. 2JU Eleven De Luxe Receiver, July, 1948; the 10-watt Transmitter, June, 1953, and the Small Oscilloscope, of October, 1957. Many thanks for expression of sympathy, which is much appreciated.

R.E.C. (Bankstown, N.S.W.) sends us a subscription for 12 months of "R. TV and H.," for which we thank him. He also says that he has built the All-wave Battery Two and now wishes to add further coils to it so that he may listen to police, taxis, tow waggons, etc.

A.: Most of the tow waggons, ambulance, police and taxis use FM rather than AM transmission and operate on the V.H.F. bands. The All-wave Battery Two is not at all suitable for this type of reception, so we cannot help him. The circuitry for these bands, and for FM in particular, is more complex than that found in conventional domestic broadcast and shortwave receivers.

J.L.W. (West Heidelberg, Vic.) has a number of old sets on hand and wants to use the parts to build receivers and amplifiers for experience.

A.: We have produced a number of circuits along these lines, J.L.W., being known as the "Basic" series. They include both receivers and amplifiers, but we have no high-powered amplifiers in this group. Also we regret we cannot identify the set you describe. However, if you care to use our postal service we would be happy to send what circuits we have.

M.C.G. (Coburg, Vic.) sends us some suggestions for improvement of the Audio Oscillator of April, 1960.

A.: With regard to reducing the depth of the chassis, we suggest that it could be done, but, in fact, the components can quite easily be reached with the chassis size we have recommended.

The pilot light causes no hum trouble in its present position, and we think its actual position becomes a matter of personal choice.

Certainly a "steel shield around the transformer" would reduce the hum at its source—provided it was about an inch thick! We feel that the aluminium shielding we have used, combined with careful layout, is the most satisfactory method of hum reduction.

We could have used a suitable resistor in the power supply instead of the choke, but we considered that the extra filtering of the H.T. by the choke for a given voltage drop more than co pensated for the remote possibility t the choke might induce hum magneti ly.

We could also have used a thermis in the AC line to limit voltage surges the valve filaments. However, valves manufactured initially with tolerance this type of surge, and we have ne had any failures, due to this troul over many years and with hundreds valves.

Similarly, experience has shown t shielding heater leads does not prov much benefit in regard to hum proble The thermistor is manufactured S.T.C. It is well known to most cc petent radio parts suppliers.

C.T.W. (Evelyn Central, Q.) writes to inquire about a simple general cov age short wave superhet. C.T.W. sugge that we could feature an up-to-date u something better than the average du wave receiver but not as ambitious a full scale communications receiver.

A.: Thank you for your suggesti C.T.W., we shall certainly keep it mind. Meanwhile, we can offer seve short-wave receiver circuits using type valves and components which n be purchased through disposals at reasonable cost. If properly aligned, th performance should not be much bel than of more up-to-date units. We f that on this basis, they are worthy consideration.

RADIO, TELEVISION AND HOBBIES QUERY SERVICE

TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

(5) In addition to the normal query service, chassis blueprints are available for most of our projects, showing the position of all holes and cutouts for metal-working but containing no details of wiring, etc. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in x 8in glossy print; postage 9d extra.

(6) Letters should be addressed to the Technical Editor, "Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

(7) "Radio, Television and Hobbies" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications of merchandise must be obtained from our advertisers.

(8) Technical queries are not answered by telephone.

L.S. (Villawood, N.S.W.) sends in a ribution to the "Reader Built It"

: Thanks for your effort, but you d have to supply a sketch to illus- your idea more clearly. As it is, an only guess at the way you have

R. (Sandringham, Vic.) sends us an native circuit for the power supply e "All Band Three" of August, 1959, asks if it would be suitable. He asks where to put a dropping resistor duce the H.T., what value was the l H.T. in the prototype, and the ns for the heater balancing pot and 0.001 uF capacitors across the r transformer secondary.

: We find it a bit difficult to specify alue of a suitable dropping resistor, as you have not shown the value ie field coil. However, we suggest try inserting resistors between the ier and first filter capacitor, aiming n H.T. of about 150 volts.

for the heater balancing pot, we der it necessary, as it allows hum duced by effects in the valves (which ore prevalent in disposals valves of own vintage) to be cancelled.

e capacitors across the power trans- er secondary are to by-pass signals .F. frequencies, arriving via the , to earth. These signals can be lated by the mains frequency, and can cause hum in the receiver. If lation hum does not seem a pro- in your district, the capacitors be omitted.

. (West Hobart, Tas.) writes to offer nber of suggestions concerning the zine. These include an expansion e Trade Review section to cover a range of products and provide a critical review. He also suggests nversion unit which would enable transistor radios to be used as adios, providing an RF amplifier ower output stage into which the stor set could be plugged. Finally, ants to know what order of dis- n is normally created by conven- speakers.

Many thanks for the suggestions and we will keep these in mind. rtunately, the type of trade review ave in mind would take more time space than we can devote to it at nt. However, we may be able to mething along these lines in the e. A conversion unit along the lines suggest may be possible, and one RF amplifier already has been bed in the Reader Built It section. ever, it may not be so easy to a unit which would suit a wide y of receivers, and we would have ve this matter some thought. We t quote distortion figures for com- al speakers, since we know of no facturer who is prepared to release nformation. However, you may rest d that the speaker you quote is g the top ranking units, and capable ery fine performance by present irds. Your subscription has been rded to the appropriate department, which a receipt will be issued

. **(Rosebery, N.S.W.)** tells us that s read about Hartley oscillators in November, 1959, issue (Answer and he wishes to know how to a crystal into the circuit. He es a circuit for our comment.

We assume from the circuit that wishes to make a simple trans- . This can be done with a crystal Mic. and Hartley oscillator, but such a transmitter would be frowned upon by the P.M.G.'s Dept. even if the operator was in possession of the necessary licence, which can only be issued by that Dept. In general, experimental transmitters may only be operated within the amateur bands, and in addition, they must be stable and accurate in their operation.

On the other hand, Hartley type oscillators are frequently used as the basic oscillator in a wide variety of electronic equipment. We suggest A.S. refer to a suitable text book, such as the A.R.R.L. Handbook.

W.H. (Rosedale, Vic.) writes to suggest that we describe a TV set capable of operating from a 32 volt lighting system, or even a 12 volt battery. He points out that the probable advent of country TV should produce a demand for such a set.

A.: Many thanks for the suggestion W.H., and we will keep this idea in mind. Yours is the first such suggestion, but we imagine there may well be some demand. On the other hand, this would be a rather specialised piece of equipment, since the ordinary builder would not wish to undertake the additional circuitry without a reason. An alternative approach might be the use of suitable inverters to produce 240 volts AC at 50 cps.

D.M.-G. (Arncliffe, N.S.W.) asks if we could offer any advice on gaining a knowledge of radio fundamentals and principles, and asks how he should go about obtaining circuits and data.

A.: Well, D.M.-G., advising individuals as to the best way to gain theoretical and practical knowledge is rather difficult in many ways, since it is hard to know what represents a good starting point. The easiest way of learning at home, and probably the easiest on the pocket, is from books.

We review text books from time to time in an effort to help readers in this respect, and most of the larger bookstalls are helpful in making books available for examination. Thus it is often very rewarding for a beginner to pay a visit to the local booksellers and discover some books which he feels are suitable for his state of learning and interests.

Books which may be worthwhile examining in this regard are:

"Wireless for Beginners," by C. L. Boltz.

"Foundations of Wireless," by Scroggie.

"R.C.A. Receiving Tube Manual."

"Radio Physics Course," by A. H. Ghirardi (out of print).

Other books of merit are of course available, including books of the imported paperback type.

In addition, we ourselves have from time to time published theory articles, such as the "Learn while you Build" series of March-December, 1951, the "Teach Yourself Radio" series of October, 1952-February, 1953, and numerous one and two-valve sets of the past. In the future, we will continue to present simple constructional articles for the beginner which will also contain a measure of the essential theory.

As for the way of obtaining circuits and other data for the construction of sets and other equipment, we conduct a query service for the benefit of readers, the details of which appear on this page. We also offer a back issue service for the supply of fairly recently issues.

NEW AND USED
TAPE RECORDERS

ALL MAKES FROM
£27-10-0
GRUNDIG, ELIZABETHAN, SAJA, TELEFUNKEN, CLARION, NOVA, PHILIPS, ETC.
Backed by our Special Warranty and our own large service division

Largest stock in Australia
Tape Decks from £22.
(BSR, GARRARD, COLLARO, NOVA, TRUVOX, ETC.)

PROJECTOR & TV OWNERS
Save £'s—Avoid Trouble
EXTEND the life of the picture tube, projector globe floodlight by eliminating the fatal "switch-on surge" and "over voltage"—fit a "NOVA" SURGE SUPPRESSOR
Size A—For Projectors and globes to 150W 29/6
Size B—For Projectors and globes 200W to 300W .. 32/6
Size C—For Projectors and globes of 500W 35/6
When ordering by mail add 2/6 for registered postage.

TRANSFORMERS (Audio, Power, Transistor etc.) to your or any specifications. Rewinds a specialty.

BIAS/ERASE OSCILLATOR
Coils for all makes of tape-decks & Heads.
Send self - addressed stamped envelope for details of our products. Tape heads 2 and 4 Tracks, Stereophonic. Many makes.

"NOVA"
311 Sussex St. or
122 William St., Sydney
BM6138, FA8393
XY6721 after hours.
Please write for complete price list of new and used recorders.

TRANSPORTA IN 4, 6 OR 7 KITS

NEW R.F. STAGE

PRINTED CIRCUIT REDUCES HISS, INCREASES SIGNAL

Avoid neutralising and critical layout.

Convert your Transporta 6 or 7. Fits same chass

Write for circuit and list of parts.
Ideal for car radios or long range portable.
Uses S.T.C. or A.W.A. transistors.
R.F. Stage printed circuit board P/No. 567 20/- plus 25% S

PRINTED CIRCUITS

558	Amplifier Audio Transporta 6 & 7	
559	RF Section Transporta 6	20/- ea.
562	RF Section Transporta 7	Plus
569	Audio & RF Section Transporta 4	25%
568	TV Video Strip R & H	S. Tax
567	RF Stage 3 gang	

COIL KITS

560 for Transporta 6	76/-
563 for Transporta 7	105/-
570 for Transporta 4	54/-
571 for TV Video Strip	60/-

Plus 25% S. Tax

DIALS AND KNOBS

453 Dial and Knob 300 pf Gang 10/-
455 Dial and Knob 415 pf Gang 10/-
458 Dial and Knob 300 pf Gang 10/-
Above prices are plus 25% Sales tax

R.F. Stage Coil Kit. Part No. 575

Uses 7 Transistors

Part No.	
249C	Aerial coil with rod.
252	R.F. Coil.
248	Osc. Coil.
176	I.F.
175	I.F.
558	Amplifier Audio printed circuit board.
567	R.F. stage, 3 gang printed circuit board
438	Dial and knob kit.

£5/2/6. Plus 25% Sales Tax.

TRANSISTOR COI & IF'S

Part No.	
248	Osc. Coil
249C	Aerial Coil and Ferrite Rod
174	Single Tuned IF 455kc
253	Car Aerial
252	RF Coil
175	Single Tuned IF 455kc
176	Dble. Tuned IF 455kc Med. Gain
177	Dble. Tuned IF 455kc High Gain
178	Dble. Tuned IF 455kc Low Gain

Above prices are plus 25 p.c. Sales

R.C.S.

R.C.S. Radio Pty. Ltd.

651 Forest Rd., Bexley, N.S.W. LW3491-53

SOLE FACTORY REPRESENTATIVE—VICTORIA—

Distributors Corporation Pty. Ltd., 403 Bourke Street, Melbourne. MU3

ORYX

MINIATURE SOLDERING INSTRUMENT

(LOW VOLTAGE)

PROTECT your transistors with ORYX. There is a danger of damage when soldering to transistor leads, due to A.C. leakage currents. The use of a low voltage transformer supply, with earthed secondary is therefore recommended. The ORYX iron, and a heat-sink such as heavy pliers gripping the lead between the contact point and the transistor will ensure protection.

Australian Distributors:

MANUFACTURERS SPECIAL PRODUCTS PTY. LTD.
47 York Street, SYDNEY. B 0233
MELBOURNE: Amalgamated Wireless (Australasia) Ltd.
ADELAIDE: Newton McLaren Ltd.
BRISBANE: Chandlers Pty. Ltd.
PERTH: Atkins (W.A.) Ltd.;
A. J. Wyle Pty. Ltd.
Carlyle & Co. (1959) Pty. Ltd.;
HOBART and LAUNCESTON: Amalgamated Wireless
(Australasia) Limited.

Amust for Transistors

PACE JOURNEYS—FACT OR FICTION

(Continued from Page 19)

e triggered by an electrical impulse the fuel burns on the entire surface e hole.

e hot gases produced are forced of the hole and produce the thrust. e propellent must be cast into the with extreme accuracy so that it withstand ground handling for, if a develops in the propellent, com- on could take place in the crack a possibility of explosion.

UID PROPELLENTS

her propellents consist of two d chemicals which are contained in ate compartments inside the rocket. n in use these are fed by some suit- means into the combustion chamber mixed before ignition. Diagrams of and liquid propellent systems are here as printed in the Space Hand-

e Space Handbook gives accounts me interesting possibilities in the of different means of rocket pro- on. One of the most unusual is dea of using solar radiation for the se when the rocket is well away the earth or other planetary bodies. t in wide open spaces a very small nt of power is needed to alter the tion of the ship or accelerate its l.

lar propulsion is of two kinds. One s use of the "radiation pressure" lar rays. These bundles of radiant gy or photons would impinge on a lightweight surface attached to the and as the supply of "fuel" is end- no storage tanks would be required. e other scheme is to use the solar to heat hydrogen gas which would be expelled through a nozzle and uce the desired thrust. The name to these devices is "Solar Sail."

nother interesting proposition is d Ion propulsion. The idea is to the molecules of propellent an elec- charge—ionising them—by passing over heated metal grids.

CTRIC ACCELERATION

aving ionised them it would be pos- to accelerate them through a le by means of an electric field ar to the way electrons are acceler- in a television picture tube. It has estimated that the values of specific lse generated in this way could be igh as 20,000 seconds. The weight he apparatus for generating high of electric charges required would o great as to make the scheme at ent impracticable.

f course, investigation is going on rding the possibility of producing st by nuclear reactors. The work- gas required could be made by pass- a fuel through a fission reactor. e again the weight of the required ratus would be too heavy for im- iate practical use.

nother suggested scheme is to gen- e high intensity light and emit it the rocket in a focused beam. A in amount of thrust would be gen- ed but the size of the gear required be gathered when it is seen that a large military searchlight yields less than one 10-thousandth pound of thrust for every 100 kilowatts of power used.

Before we close this discussion it would be of interest to give the Select Committee's comments on the so-called 24-hour satellite. These will serve to bring into proper perspective the usefulness or otherwise of such a satellite.

This satellite gets its name from the fact that if it was placed in orbit over the Equator and travelled eastward when viewed from the earth, it would appear to stay always at the same point in space. The altitude required for such a satellite is 22,000 miles, and it would have in view about 38.2 per cent of the earth's surface or about 75 million square miles.

It has been suggested that it would be possible to observe activities on the earth from such a fixed position in space.

NOT HOPEFUL

An analysis of the situation does not make such a possibility very hopeful, even if we envisage the possibility of equipping such a satellite with telescopes similar to those on Mount Wilson or Mount Palomar—the most powerful known to man.

If, says the committee, account is taken of the practical limitations of photographic film, etc., it appears that achievements of a reasonable resolution would require a lens diameter of 8 feet with a focal length of about 64 feet. This is the size of the Mount Wilson telescope.

Further, suppose that the cameras were used to take photographs 4in. by 5in. in size of an area at about 45 degrees latitude. The region photographed would be about 152 by 197 miles or approximately 30,000 square miles. The achievement of good resolution of the picture would be an engineering and scientific feat of the first magnitude. The requirements of stability of the camera for any reasonable exposure time would be formidable indeed.

However, there is one application for such a satellite which would not require such optical systems. That is the field of weather observation. No high degree of ground resolution would be required and the enormous view obtained from such a height would be of great value.

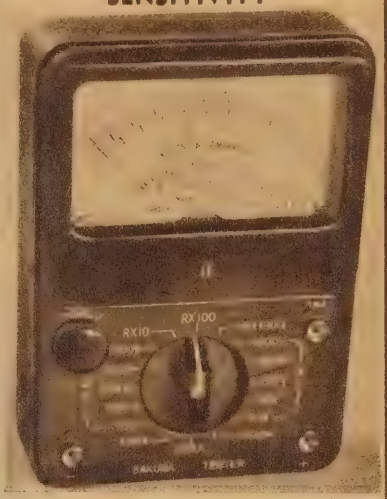
A LONG WAY TO GO

While tremendous progress has been made in the design of rockets and rocket-ships the possibility of manned space flights in the near future cannot be considered until a great deal more experimentation has been carried out. Calculations have shown the feasibility of some extensive flights such as flights around the moon and to even greater distances.

The problems associated with the projects are so vast and critical that any forecast as to when such flights will take place is mere guesswork.

"SAKURA" TR4H TESTER

20,000 OHMS PER VOLT SENSITIVITY



Volts, ohms, M.amps. Size 5¼in x 3¼in x 1¼in. 17 ranges AC and DC.

Post Free. £9/3/6 Trade Price.

Including Sales Tax, Battery and Test Leads.

With leather carrying case to suit.

£10/2/6

"Transistorised" HEARING AID £15/15/-

This miniature instrument incorporates the latest transistor amplifier and operates for months from one small pen torch battery. Replacement cost 1/-. It is supplied to you complete with battery and one spare.
The complete article is packed in a presentation leatherette zippered case.
Volume control and ON/OFF switch are combined, very easy to operate and similar to a transistor radio.
Microphone, Amplifier and Battery are fitted into the Gold-finished, unbreakable metal case, 2¾in x 2in x ¾in thick, which has clips for fixing to pocket or clothing. The earphone is connected by fine P.V.C. wire and plugs into the unit.

MAIL ORDERS

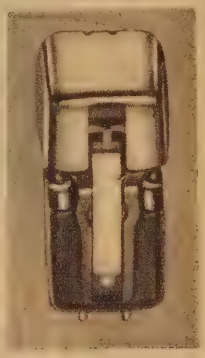
Radio House Pty. Ltd.

296 Pitt St., Sydney

Also available at: 6 Royal Arcade and 760 George Street, Sydney.

General Electric Hi-Fi

VR-22 stereophonic magnetic variable reluctance high fidelity cartridges



MODEL VR-225
(With .5 mil diamond stylus for professional quality tone arms) **£19/19/6**

MODEL VR-227
(With .7 mil diamond stylus, for professional arms and record-changers) **£18.**

Outstanding in All Four Areas of Stereo Cartridge Performance . . .

- Full, Flat Frequency Response, 20 Through 20,000 Cycles plus or minus 3 db (Model VR-225).
- Unusually High and Consistent Channel Separation, up to 28 db.
- New Stylus Assembly for Optimum Compliance and Precision Tracking. New Triple Shielding for Positive Hum Suppression.

GENERAL ELECTRIC

NOW: the **G.E. "STEREO CLASSIC" compatible stereo and** monaural tone arm model **TM2G.** Designed specifically for use with the **G.E. VR225** and **VR227** stereophonic cartridges. Modern styling with brushed aluminium and chrome finish. Maximum tracking error—2 degrees. Tracking force adjustable between 0 and six grams. Your **G.E.** cartridge deserves the finest arm.
Price including tax **£25/10/-**

supplied throughout Australia by

Fidelity AE Audio Engineers PTY. LTD.

NOW AVAILABLE FROM YOUR HI-FI DEALER

THREE-INCH CRO

(Continued from Page 73)

resistor in the probe. Very little adju ment of this nature should be necessa

The third probe to be considered the demodulator probe, the circuit which is shown on page 67. This is quite so important a probe as the already considered, but it is very use It has a bandwidth approximately 2.5 and will reproduce the video content the signal, at any point in an IF am fier, with a tolerably small amount distortion.

SIMPLE DETECTOR

Most readers will be familiar with usual, simple detector circuit such may be used to check a sweep generat There is generally a diode, one or resistors, and a filter capacitor. S a unit was described in the Sweep G erator article in the issue of May, 19 For the reproduction of the 50 square wave produced by the swe such an arrangement is quite adequate

However it is often handy to be a to "signal trace" through IF amplifi and to examine the waveform at vari points in the circuit. For this purp the response of the simple detector not good enough.

Handling such waveforms prese problems identical with those met video amplifiers, where stray capacita causes attenuation of the high quencies. The loss must be compensa for by various means already discuss

With a probe, the main loss is to the cable capacitance, and the C input capacitance, being shunted acr the output. Sometimes, by employin special very low loss cable, and by c necting the cable directly to the vert amplifier grid, it is possible to red the shunting capacitance to a negligi amount, but this is a very complica procedure and we have preferred adopt other methods.

The cathode follower probe has input capacitance of only a few pF is already provided with a lengthy p of cable. Therefore we have construc a short, light detector probe which c on to the end of the cathode follo the combination making an ideal, loss demodulator probe.

CIRCUIT DETAILS

As will be seen from the circuit, chokes are used; the 120 uH forms, gether with the 22 pF and the shun capacitance of the cathode follower wiring, an RF filter for intermediate quencies, and the 270 uH is a sh peaking choke which helps extend probe response into the video region.

The diode load resistor is only a 3. This low value is necessary to coun act the effect of strays but it also duces the voltage output. Conseque this probe is not as sensitive as sim types but in practice it has proved quate.

For the prototype we have used ments of materials lying about the w shop. For the case we used a Phi tin plate valve shield measuring 2in and just under an inch in diameter w just happens to fit the standard mou ends provided for the larger probes.

However, we have arranged with

(Continued on Page 126)

ARS OF THE FUTURE

(Continued from Page 7)

s compression ratios up to 20 to 1 possible with this engine, it may operated on the diesel cycle. It ady has been used as a supercharger, n several years ago it was operated blower on the world record-breaking c.c. "Quickly" engined NSU motor e.

he gas turbine as a prime mover for or vehicles has been under develop- t and test for quite a long period, probably every leading car company developed an engine of this type ch it could market if the other pany markets theirs.

ut there is no rush to be first in the because the turbine is as yet costly nake, and relatively heavy on fuel. ecause the turbine achieves best nomy when operating on heavy loads at relatively steady speeds, it will its best application in long distance mercial vehicles, where its great ue at low speeds, splendid reliability, high power to weight ratio will be siderable assets.

leading American motor company currently developing a gas turbine er pack about which it is very usiastic. This comprises a low- ssure, low speed main turbine super- rged by a particularly tiny, high ed turbine.

he unit includes two burner stages is fitted with heat exchangers to uce fuel consumption, which has been matically reduced, by this efficient ngement, down to the diesel range.

OMPETITIVE PRICE

he manufacturers expect to be able market this turbine power plant at price of a high quality diesel engine. s is about the same as the cost of hand-finished engines used in the ld's best cars.

An entirely different type of power t is known as the "fuel-cell," which being urgently developed by the tral Electricity Board of England, by the defence departments in Russia the United States. It can be used electric power generation as well as ship or vehicle propulsion.

Reduced to simple terms, the principle which the unit operates is the feeding a gas to a multitude of fuel-cells, which chemical reactions are set up use the gas in generating a flow of trons (electricity).

he electrical power thus generated ed to an electric motor to drive the icle or ship, or it may be used for other of the numerous purposes to ich electricity is put.

he American Allis-Chalmers Com- y has successfully developed such a er unit for use on its tractors. The l-cell battery is housed in the normal tor engine space, whilst compressed pane gas to feed the cells is carried the rear of the tractor.

n this application about 1,000 fuel- s are used, and these produce about kilowatts of electrical power, which fed to an electric motor which in n produces a draw-bar pull of about 00lb, on which the tractor performs agricultural duties.

his type of power unit is quite bulky the power produced, but cheapness the gas used as fuel, as well as plicity and expected reliability of the er unit, are important factors.

The intriguing aspect of the fuel-cell unit is an efficiency of 85 per cent, which is more than double that of an internal combustion engine.

We can look forward to quite exciting changes in our cars in the decade ahead. I feel that the era of detail development will give way to a period in which fundamental and basic changes will occur, and that our cars will change in their very nature and conception in the next 10 years.

THE PUBLIC SERVICE OF

PAPUA AND NEW GUINEA

RADIO TECHNICIANS

Senior Radio Technician

(several positions)

£1,584-£1,660 p.a. (single)
£1,734-£1,810 p.a. (married)
(actual rates)

Qualifications: Qualified as P.M.G. Senior Technician (Radio) or equivalent.
Duties: In charge transmitting and receiving stations; V.H.F., M.F./H.F., C.W. and radio-telephone trunk and out-station services.

Radio Technician

(several positions)

£1,354-£1,485 p.a. (single)
£1,504-£1,635 p.a. (married)
(actual rates)

Qualifications: Qualified as P.M.G. Technician (Radio) or equivalent.
Duties: Assist in maintenance and installation communications, transmitters and receivers V.H.F., M.F./H.F.
Appointment: Permanent or fixed term appointment. Officers of Commonwealth Public Service will be considered for transfer pursuant to Section 43 of Public Service Act for period of up to two years in first instance.
Accommodation: Single quarters available; married accommodation unlikely to be available under 18 months from date of appointment.
Separation Allowance: Payable at discretion of Territory Administration; designed to compensate for added expense of married appointees obliged to maintain family outside Territory.
Child Allowance: For first dependent child under 16 years — £52 p.a. For subsequent dependent children under 16 years — £65 p.a. All officers receiving adult male rates of salary are required to contribute £26 p.a. towards cost of allowance.
Leave: Three months after each 21 months in Territory and 6 months' furlough after 20 years. If permanent, additional 3 months' leave after each 6 years.
Further Information: An information handbook on the Territory and its Public Service is available from Department of Territories, Canberra or Sydney, or from any Commonwealth Public Service Inspector, Commonwealth Employment Office or official country Post Office. Other enquiries to Department of Territories, Canberra (phone 7-0411, ext. 29A).

APPLICATIONS

SUBMIT on prescribed form available from above offices —
TO — The Secretary, Department of Territories, Canberra.

Write for Catalogue of Prices

ROYCE **DISC RECORDING EQUIPMENT**

VIC. BOX 5041Y, G.P.O., MELBOURNE. FB2592
ROYCE RECORDING SUPPLIES, 291 EXHIBITION ST., MELB.
S. A. SCOTT SALES, 99 CURRIE ST., ADELAIDE, LA1201, ML4919.

BOOKS

RADIO SERVICING: Combined Volume. NEW. Yes, here are Vols. 1 to 4 (each available at 7/6 if required separately) now in the one handsome, cloth - bound volume. Price 31/-.

RADIO SERVICING is, in itself, a complete course in radio, but at the same time conditions—and trains—the reader in the right way to go about servicing. And now—something else NEW!! RADIO SERVICING: Vol. 5 and Vol. 6 are both available at 12/9 per copy each. Test your knowledge! If you can get through all the questions (taken from Intermediate and Final examinations, respectively) then you can really call yourself properly trained. All questions give specimen answers.

THE RADIO AMATEUR OPERATOR'S HANDBOOK (1960 edition). Price 5/. This work has just been released, and is regarded as indispensable to the short-wave listener or would-be ham.

THE COOPER-SMITH TYPE BP1 AMPLIFIER and THE COOPER SMITH "PRODIGY" AMPLIFIER. . . . Each of these booklets costs only 3/9

SHORT-WAVE RECEIVERS FOR THE BEGINNER. Price: 8/9

THE OSCILLOSCOPE BOOK. By Bradley. Always in great demand. Price: 7/6

OSCILLOSCOPE EQUIPMENT. By Easterling. Price: 7/6

TV FAULT-FINDING from Data Publications Ltd. Price: 7/6
(Please note that we give a free, ronecoed sheet with every imported TV book we sell, so that you may make allowances for differences in our and U.S.A. or U.K. standards.)

PRACTICAL TV AERIAL MANUAL. A first-rate book. Price: 7/6

HOW THE SCHOBER ELECTRONIC ORGAN WORKS. Price: 5/

ELECTRONIC MUSICAL INSTRUMENTS—by Dorf. New Print. Send for free brochure on our books dealing with electronic organs. Price: 77/6

ELECTRONIC NOVELTIES FOR THE CONSTRUCTOR. Price: 7/6

ELECTRONIC GADGETS FOR THE CONSTRUCTOR. Price: 5/3

SERVICING TRANSISTOR RECEIVERS, by Pettit. Price: 8/9

HOW TO GET THE BEST OUT OF YOUR TAPE RECORDER. Price: 12/9

MAGNETIC RECORDING: WIRE AND TAPE. Price: 6/9

The above books, whilst readily available by mail (only) from us, may also be bought at the following firms in Australia and New Zealand: **SYDNEY:** Angus and Robertson, Dymocks' Book Arcade, General Accessories, Price's Radio, Swain's. **MELBOURNE:** McGill's Authorised Newsagency, Technical Book and Magazine Company. **BRISBANE:** General Accessories (Edward Street), Barker's Book Store, A. McLeod, Qld. Book Depot. **ADELAIDE:** Beck Book Co. **PERTH:** Alberts Bookshop, Whitcombe and Tombs. **HOBART:** Oldham, Beddome and Meredith. **CANBERRA:** Verity Hewitt. **GEELONG:** Griffiths (Ryrie Street). **ROCKHAMPTON:** A. McLeod. **LAUNCESTON:** Birchall and Sons. **WOLLONGONG:** Coddington's Newsagcy. **MARYBOROUGH,** Q.: Denradio Industries. **AUCKLAND, WELLINGTON:** Whitcombe and Tombs, Technical Books.

IMPORTANT NOTE: Whilst we distribute the books **above,** those shown below may not—in some cases certainly will not—be stocked by other firms.

NEW BOOKS

COMPUTERS and how they Work. By James Fahnestock. A brand-new publication from the U.S.A., written by an acknowledged expert, and in simple, right-from-the-very-beginning talk. Thoroughly recommended. Price: 55/6

101 MORE WAYS TO USE YOUR OSCILLOSCOPE IN TV—by Middleton. This book, which will be available at the end of September, contains 101 new and not previously published tests. This work is a **must** for the TV serviceman. Price: 25/9

Just Published. THE AUSTRALIAN RADIO AMATEUR CALL BOOK (1960-61). Price: 6/6 (incl. post.)

ELECTRONICS MADE SIMPLE. Price: 12/6 (incl. post.)

Send for our free, up-to-date list of the hundreds of books we stock. No obligation to buy!

LAST CHANCE! We have just landed another big shipment of **THE RADIO AMATEUR'S HANDBOOK** (1960) published by the American Radio Relay League. After these have gone, you will be unable to get any more for six months. Price: 46/6

HERE'S NEWS. **Heywood and Co. Ltd.,** one of the largest publishers in the Empire, have just announced a new **weekly paper, "ELECTRONICS WEEKLY."** Have it mailed direct to you from London, each week. The price is really reasonable. **£A1/12/ per year**—and—as a special introductory offer, you get 13 months' issues for your remittance. Yes, we shall take your order and cable it off promptly. Remember, we guarantee deliveries.

Talking of subscriptions, have you seen **THE RADIO CONSTRUCTOR?** This is Britain's "Radio, TV and Hobbies." A year's subscription will cost you **£A1/12/** and, if you ask to see back issues, we have the following arrangement to offer. One copy 1/6, (Ask for the sun-powered, Transistor receiver issue), additional copies—up to 3 only per customer—**6d each.**

Lastly, for this month . . . Do you read **AMATEUR RADIO?** This is an **Australian** radio monthly published by the body run by hams for hams—**The Wireless Institute of Australia.** Send us 24/, and we will arrange a year's subscription for you. While you are at it, add another 6/ only, and we will send you a copy of the abovementioned new edition of **AUSTRALIAN RADIO AMATEUR CALL BOOK,** making 30/ the lot.

ELECTRONICS PUBLICATIONS

(AUSTRALIA)

A Division of The Electronic Organ Company (Australia),

11 CADOW STREET, PYMBLE, N.S.W., AUSTRALIA.

Our business is conducted by mail, solely. No books are sold at this address, which is that of our Registered Office, only.

THREE-INCH CR

(Continued from Page 124)

manufacturers to produce a small p housing suitable for this, and probes, and it should become avai shortly through normal trade chan

Inside the probe a small, five-pi board is used to mount the minor ponents. The tag at one end of board is soldered to the threaded po of the probe tip in the moulded end tion, while the tag at the other en soldered to the sleeve which fits o the cathode follower tip. This "sle is the sleeve section of an alligator whose clip section is cut off and disc ed.

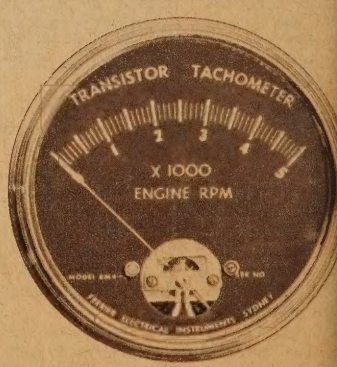
EARTH CONNECTION

A small piece of shim brass is soldered to the earthy tag, in suc manner that the free end is squeeze between the case and the end moul when the case is in place. This is actly the same arrangement as in divider probe. Finally, the back moulding is slipped on and screwe the case.

The probe is earthed back to cathode follower case by means c clip lead. At the probe end it is s ered to a solder lug held under one the case screws, and at the other it clips on to one of the cathode follo case screws.

The photograph on page 73 is of waveform at the output of the video tector. The cathode follower probe used here for minimum loading an gives an idea of the performance of CRO as a whole. The demodul probe should produce a waveform similar to this from any point in the amplifier.

FERRIER



MOVING COIL METER MODEL RM4-2

This meter has been designed for **TRANSISTOR TACHOMETER** use. It has a black face with white figur and is enclosed in a 4-inch chrome case Available from wholesalers and dire from manufacturer.

PRICE £6/15/-
(Tax included).

FERRIER ELECTRICAL INSTRUMENT
43 ALBANY ST., CROW'S NEST, N.S.W. 43—559

'S BUY AN ARGUMENT

(Continued from Page 95)

than "cheap," it might have been to have said "of dubious origin," posed to components newly manu- ed and recently calibrated.

Does an autodyne converter gen- te less noise than other types? ave heard arguments both ways.

s is a very general question to one can offer only very general r.

ir question possibly relates back e days when pentagrid converters displacing pentode type autodyne ency changers.

hose days it would almost certainly ie to say that the autodynes were in terms of noise but they were ded for other reasons, as under:—

They were more prone to drop f oscillation;

They were less suitable for dual- circuits;

They did not lend themselves to ype gain control.

TED APPLICATION

ce those days, self-oscillating s (i.e. "autodynes") have found d use in FM and even TV re- s. They are still regarded as rather l, in terms of associated circuitry, nsuitable for connection to an AGC n.

wever, when operating correctly, appear to have good noise charac- cs, though not necessarily better comparable mixers employing sep- injection.

various reasons, most VHF re- s employ an RF stage ahead of ixer and the characteristics of this, than of the mixer, determine the ll signal/noise ratio.

impression is that self-oscillating s are used mainly for reasons of my—not for any other character- they possess.

Why are output valves rated dif- ently for fixed bias and self-bias? s is one I just can't understand.

you take a closer look at valve s, you will find that the difference dom apparent when the valves are under pure class A conditions.

THODE CURRENT

e reason is that the cathode cur- remains substantially constant, ier or not the valve is delivering t. Thus optimum and constant bias e derived, either from a fixed ex- l source, or from the valve's own de return circuit.

ere the valve is operated in an iased (and usually push-pull) con- , the average cathode current is constant, but rises with increasing r output.

is variation in cathode current does affect the bias when it is derived an external source. A bias voltage herefore, be chosen which:—

represents a suitable working point which the grid voltage can swing

insures that electrode current and ge ratings are not exceeded in any nstances.

sed on this working point, figures e derived for optimum load, power t, distortion and for electrode cur- with and without signal.

With cathode bias, the position is quite different.

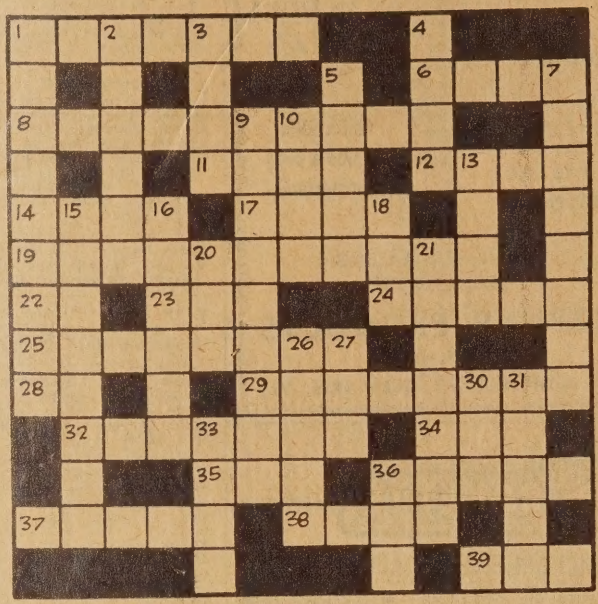
A cathode resistor may initially be chosen which provides optimum bias under maximum current, high-drain conditions. In practice there is a strong chance that this will be too small in value to prevent excessive electrode dissipation under no-signal conditions, when the full power input is dissipated in the valves themselves, and with none being diverted into the load.

COMPROMISE

If the resistor is increased to limit valve electrode dissipation, the bias under full signal conditions will normally be higher than would otherwise have been chosen. A new value of load may be necessary to make the best of this amended working bias region, while there will also be differences in power output, distortion level and electrode currents.

This should answer your question.

THE R., TV & H. CROSSWORD No. 77



ACROSS

1. It produces its field from permanent magnets.
6. A single element.
8. Portion of a transmitter's wave which travels along the earth's surface.
11. Sign of authority.
12. Tumour of the eyelid.
14. Diminutive suffix.
17. Carriage for the dead.
19. Often televised, but it never entertains.
22. Short right.
23. A success.
24. Mood music.
25. The distance measured vertically on a graph.
28. Refusal.
29. They hop in a hotel.
32. Show.
34. Abb. for native.
35. Poetical over.
36. Hunts.
37. Guide.
38. Type of coil winding.
39. Country.

DOWN

1. A two element vacuum tube.
2. Unwanted picture on a TV screen.
3. Ages.
4. Moneys to be paid.
5. Gentleman's gentleman.
7. These speakers reproduce the high audio frequencies.
9. Open to argument.
10. Stay with patience.
13. Character of a sound.
15. Tubes with four elements.
16. The science of morals.
18. Expose hemp.
20. Fastener.
21. Food.
26. Lacerates.
27. English cathedral.
30. Decoration.
31. Toys.
33. Opening.
36. Equality.

Last month's solution

C	O	N	T	R	A	S	T		D					B
A		O		H			E	N	E	R	G	Y		
T	A	N	D	E	M		T		V			P		
I		R		O		S	R		I	N	C	A		
O	V	E	R	S	H	O	O	T	S			S		
N		A		T	O	A	D		E	R	G	S		
		S	C	R	A	P	P	E	D		O			
R	O	T	A	T	E	S		I	N	N	E	R		
E	D	I	T	S				V		T	O	E		
C	A	V	E			A		E		G	A	S		
O		E	D	D	Y	C	U	R	R	E	N	T		
R				O	E			T		N		E		
D	E	T	E	C	T	O	R	S				D		

Printed and published by Sungravure Pty. Ltd. at the registered office: 21-29 Morley Avenue, Rosebery, N.S.W.

ZEPHYR

TYPE 30 RIBBON

30RD-50ohms
30RA-Grid

Freq.
50-10,000 c.p.s.

5/8 26 t.p.i.
Stand Mount

£16/1/-
Plus tax £1/13/5

£17/2/-
Plus tax £1/15/8

Finish Satin Chrome & Grey Hammertone.

AVAILABLE LEADING RADIO HOUSES.

ZEPHYR PRODUCTS
PTY. LTD.
58 HIGH STREET, GLEN IRIS. Vic.

AWA RONETTE

MICROPHONES & ACCESSORIES

Type 088/F

£9/5/11

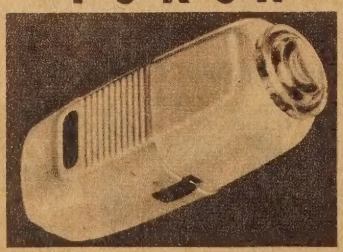
Complete with flexible arm.

Technical pamphlets will be mailed on request.

Other types also available from

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED
nr. William and Newcastle Sts., Perth.
and leading wholesalers.

Rechargeable
TORCH



Pocket Torch which operates without dry batteries. Rechargeable Torch, just remove back and plug into the power point, recharges overnight. **59/6** Spare globe, 2/6.

BATTERY ELECTRIC SHAVER
Operates with two batteries fitted inside the Shaver. **£2/19/6** Postage 2/6.

MAIL ORDERS

Radio House Pty. Ltd.
296 PITT ST., SYDNEY
Also available at: 6 Royal Arcade and 760 George Street, Sydney.

WANTED TO BUY, SELL OR EXCHAN

ALL BACK ISSUES R.T.V. and H. in stock at all times 1939-56 copies 1/ each. 1957-58 2/6 ea. 1959 on 3/6 ea. Post incl. Phone, write or call. **T. Weir, 56 O'Connor Street, Haberfield, Sydney. UA2569.** Wanted to Buy Copies.

COMMONWEALTH of Australia: Quotations for purchase and removal will be received by the Superintendent, Stores and Contracts Branch, Postmaster-General's Department, 64 Harbour Street, Sydney, up to 3 p.m., on 23rd September, 1960, for the following:
One (1) only Reverberation Plate Type EMT140 (Quotation S.3343).
Full particulars may be obtained from the above address.

FOR SALE: Popular Mechanics Science, 1952-1953 Hobbies Illustrated, 1946-1950. **P. Darragh, 254 Brisbane Street, Dubbo.**

FOR SALE: Vented enclosure 7 cu. ft. Felt lined Rosewood finish. £15. **XL1032, 76 Minnamurra Road, Northbridge.**

FOR SALE: Second-hand two manual organ keyboards, suitable modification amateur electronic organs. £12 to £20 per set, ex works while they last. **N.B. and B.P., Box 11, Clifton Hill, Melbourne, N8.**

FOR SALE: R., TV and H., Sweep and Marker Generator, complete, working order, requires calibration. £15. **K. Thurbon, 4 Cintra Ave., St. Kilda, Vic.**

FOR SALE: Models. Miniature Engineering. Large Range Blue Prints, Castings, etc. Catalogue price 6/. **Bolton, 72 King Street, Sydney.**

FOR SALE: Back numbers "Radio and Hobbies," 1939 to 1954, 1/6; 1955 to 1957, 2/; 1958, 3/; 1959 to 1960, 4/ each including postage. **A. J. Cox, 13 Glover Street, Belmont, N.S.W.** Also will buy 1939, 1940, 1941, 1942, 1953, 1955 to 1960 copies.

FOR SALE: Back issues R. TV and H, 9 complete Vols., 1951-1959, incl. £6 cash the lot. **C. Dewey, 109 Sproule Street, Lakemba. UL6530.**

MUST SELL: Tandberg Stereo 5-recorder. (See March R. and H.). Bot. U.S. Nov. "Shure" multi-imped. mics separ. sale. **Father Corcoran, Dunedoo.**

ORGAN CONSOLE FOR SALE: Polished, complete with seat, two manuals, fully wired, 4-contact silver under-key switches, also pedal keyboard (not wired). Excellent condition, suitable for electronic organ.—**"Organ," 1 Eden Court, Toorak, Vic.**

RADIO Service Bench 6 x 3. Inst. sh drawer, 3 sliding doors. 10 Pwr. point Dismantles, **£14. 95 Fairfield Road, E South, S.A.**

SELL: Philips TV Pattern Generator GM2891, as new, £60. **Schulze, 42 pect Road, Blair Athol, S.A.**

SELL: Playmaster 5½ Amp. Also Magna WR speaker. New. Sell at cost. **B. Wesley College, Newtown.**

SELL: Stereo amplifier, 2 x 7 watts, ultra £30. **XL1825, Sydney.**

SELL: Hallicrafter SX62 Receiver 108MC AM/Fm/CW, Loudspeaker, Excellent condition. £125. **JW3273,**

SELL: A.W.A. Voltohmyst, complete probes, instruction book. £45. Variou boxed unused 12/6 each. Philips tune Astor tuner, £10. Various components. sonable offer refused.—**WM5765, 446 North Road, Carlingford, N.S.W.**

SELL: Schober Organ Kit Concert Mode quiries, **Wisomann, LB3924; 2 Raith East St. Kilda, Victoria.**

TAPE RECORDER OWNERS. Join "Aus Recordists' Association," this country T/R club. Meetings planned all States. 200 Members. **Box 970, G.P.O., Adelaid**

TATTOOING: Electric Machines, Pigmen sign sheets, Spare Machine Parts, Ins Booklets and Blue Prints. Send 2/ fo logue to **Johnny Lee, Box 34, Ivanhoe, V**

TO BUY: Manual for Collins T.C.S. ceiver, also one for A.R.B. receive **Campbell, Box 42, P.O., Sorrento, Vic.**

"VELCO Sound." P.A. System, comple Dynamike Ribbon Microphone. Nine ternal Speakers and one External Speaker. ther details phone **UF3001 or UF2249.**

WANTED: Small Communications Re BC348, &c. Any condition. **4 Whynot Street, West End, Brisbane.**

WANTED TO BUY: L.P. records, ve price for selected records in good tion. We pay up to 20/ each for L.P. Stereos. **Radio Mart, 439 Pitt Street, N.S.W. MA2351.**

WANTED: French language records. **son, Martha Ave., Northmead, YY1316.**

ACOS STYLI

SAME HIGH QUALITY
NEW LOW PRICES

All Monaural turnover types

Sapphire ..... 6 6d. Diamond £2 7
for HGP37, GP39, GP61, GP65, GP67, etc

Stereo types

Single sapphire for GP71 6
Single diamond for GP71 ..... £2 7
Twin sapphire for GP73 18
Sapphire/diamond for GP73 ..... £5 6

Use only genuine Acos Replacement Styli for ACOS Cartridges
Detailed price list posted free on request.

AUSTRALIAN AGENTS:
AMPLION (A/ASIA) PTY. LIMITE
101 PYRMONT BRIDGE RD., CAMPERDOWN
SYDNEY, N.S.W.